## REPORT ON JAZIRAH

101 Geographically, Jazirah, i.e., "the Island", is that strip of territory lying between the rivers Dijla and Euphrates, but for the purpose of this report, the term Jazirah is understood in its administrative meaning as a Mohafaza of Syria, and will be studied as such.

### AREA OF JAZIRAH AND ITS CULTIVABLE LANDS

The "Statistical Abstract of Syria" for 1950 gives the total area of Jazirah as 2,217,000 hectares divided between the Mohafaza center, i.e., Hassakeh, Qamishli, and Dijla, in the following proportion:

| | |
|---|---|
| Mohafaza Center | 1,525,000 hectares |
| Qada of Qamishli | 392,000 hectares |
| Qada of Dijla | 300,000 hectares |

811 Of this total area, according to the same source, 444,266 hectares were cultivated in 1948-49, and 1,701,284 hectares were cultivable but uncultivated, while the uncultivable lands were only 71,450 hectares.

This terminology of cultivable and uncultivable is greatly misleading. If by cultivable is meant the lands which are not rocky or mountainous or forested, the terminology is right though it loses its economic meaning. But if by it is meant lands which can be planted and rendered productive to show some profit, then other factors have to be considered, and the productive "cultivable" area of Jazirah is greatly reduced.

132 The first of these factors is the amount of rainfall. It is really astonishing that the Syrian Government has not deemed it necessary to establish agricultural stations in different regions of Jazirah to record at least the amount of rainfall in the different localities. The only such station is at Hassakeh which is not primarily a wheat growing district and the mean annual rainfall over a period of nine years is less than 300 mm. This average is less than the minimum required for successful rain-fed cultivation.

I. The Mohafaza Center

311 Therefore about 80% of the 1,525,000 hectares mentioned as
312 cultivable in the Mohafaza Center are in fact uncultivable unless

irrigated, and the Jagjag and the Khabur could never irrigate such an area. Irrigation is the second factor involved in determining whether the land is cultivable or not.

II. Qada of Dijla

Turning to the Qada of Dijla, we find that the entire region has sufficient rainfall, two rivers and many springs in the villages. In fact, the abundance of rainfall in the northeastern part of the Qada known as Jazirat ibn Amr, makes the growing of summer crops hazardous because the hot, dry period is too short.

The lower part of the Qada, from Tal Koshak to Dāmir Kapu, is similar to the Qada of Qamishli. The land is flat and precipitation, though relatively abundant, does not compare with the more mountainous regions of Dijla.

III. Qada of Qamishli

The Qada of Qamishli with the lower part of Dijla, extends from Tal Koshak on the Iraki border, comprising the cities of Qamishli, Amuda, Derbassiya, to Ras el Ain on the Khabur which belongs administratively to Hassakeh. This region, some 200 kms. in length along the railway line and the Turkish border, is the best developed and most productive of the Jazirah.

In point of cultivability, it is divided into two parts:

1. A region bounded by the railway and a line running about forty kms. south and parallel to it, from the river Rad to Tal Brak to Tal Tamr on the Khabur.
2. The region south of this fictitious line.

This division is based on the amount of rainfall and the experience of farmers during the last twelve years. It is certain that the further one goes from the Turkish mountains, the less is the rainfall. That is why Tal Brak, about 40 kms. south of Qamishli, is considered the last profitable area for rain-fed farming. In the last few years when tractor cultivation expanded greatly and lands became scarce, new farmers cultivated the lands south of the parallel line down to Hassakeh and to a point about 40 kms. north of Rakka, and learned at their own expense that it does not pay unless the crop is barley and is carried on as a sideline to a principal enterprise in the northern regions.

A vast area lies south of the Rad to the Iraki border toward the Sinjar Mountains. Farmers have been prevented from cultivating

it because of bloody disputes between the Shammar and Tay tribes. The land is poorer than in the north and the rainfall is much scarcer. Farmers who managed to plant barley on the fringes of the disputed land in the bad year of 1951 lost heavily. It is improbable that an average year would give much hope of profit.

Ras el Ain, though on the railway line, has less rainfall than Kamishli, Amuda, or Dirbassiya because the mountains recede north into Turkey. Dry farming is profitable less than 20 kms. south of Ras el Ain.

## IV. The Khabur Valley

The Khabur river, though rising in Turkey, is fed by springs in Ras el Ain and flows southward for about 150 kms. within the Jazirah before it enters the Mohafaza of the Euphrates below Markada.

For about 20-30 kms. below Ras el Ain, the land is used for cereals, mainly barley, with varying degrees of success. But south of this area and down to Hassakeh, dry cultivation becomes risky. South of Hassakeh and to the east and west, dry cultivation becomes entirely out of the question because rainfall, already insufficient at Hassakeh, falls off sharply.

The inadequate rainfall is offset to a certain extent by the possibility of irrigation from the Khabur. Traces of old dams are apparent in several places, and canals which carried the waters from the dams are visible. History and legend leave no doubt that the valley was much more extensively exploited in former times than it is now.

Recently, when the price of rice rose during the War, farmers from the cities of Jazirah in search of irrigated land, began renting lands along the Khabur and installing motors and pumps. The necessary outlay of capital for any project of adequate size was substantial, not less thanLS 150,000, and the price of rice fell after 1946, so that perhaps not more than fifty irrigation projects existed up to 1949. It remained for the cotton boom of 1951 to boost this number to around 200 pumps.

The average size of pumps is 8" and the area irrigated by a pump of this size is around 500 dunums (125 acres). On some projects, where land is available, this area for summer crops is supplemented by an area twice this size in wheat and barley. But lands on both sides of the river rise steeply and rarely can an owner of an irrigation project find enough lands to use the pumps

full time winter and summer. This is one of the reasons why most projects on the Khabur have been failures. The overhead costs are very heavy in relation to the land available.

The Government has an irrigation project partly in operation which will irrigate when completed an area of about 100,000 dunums (25,000 acres). Other projects are under study but their execution will be postponed indefinitely since the Government lacks the necessary capital.

To summarize, it would appear that not only all cultivable lands in Jazirah are already cultivated, but that farmers, in search of lands, have started using marginal lands with insufficient rainfall, and unless the price of cereals keeps at the level of last year there will follow in the coming two years a gradual decrease in the area planted, with heavy losses to individual farmers.

## POPULATION OF JAZIRAH

During Turkish rule and up to the French occupation, Jazirah was a wasteland controlled by Bedouin tribes whose submission to the Turkish law was nominal.

### I. The Arab Tribes

The tribes, dominated by Shammar, ruled the land and spoiled it, frustrating all attempts at agriculture. They lived on sheep and camel breeding and charged tribute from merchants for protection, each tribe within its boundaries. Moslem and Christian families from Mardin and Nisibin owned lands around what is now Kamishli, Amuda and Dirbassiya, and they traded with the tribes, buying their wool, samneh, and hides and supplying them with their needs and credit. The ownership of land for agriculture seems to have been incidental to the commercial activities of these families.

The tribal boundaries established during the Ottoman rule are still effective. Shammar claims the right of grazing from the Iraqi border at Tal Koshak to Tal Alu and south to Fadghami on the Khabur. There is another small concentration of a Shammar branch around Derbassiya known as Shammar Ezzor.

The neighbor of Shammar to the west is the Tay tribe. Its lands extend from Kubur el Bid and Kamishli south to Tal Brak. The tribe took to agriculture relatively early and in its area are some of the best lands of Jazirah.

a. The Region of Deirik

241 In the region of Deirik, the Zarkan river and numerous springs
E90 in the villages make irrigation possible over vast areas. The region
began to be developed recently when the road was partly constructed.
312 Rice is an old staple, but in the last two years it have given place
to cotton. However, rice may resume its former place since cotton
diseases have become so widespread.

b. The Jarrah

The Jarrah river flows through Kubur el Bid and irrigates the country around it. Its waters were used for rice plantations, and recently for cotton. In winter its waters flow into the Rad.

c. The Jagjag

133 The main river of northern Jazirah is the Jagjag. Its sources are about thirty kilometers north of Kamishli, in a gorge in Turkey. It flows through Nisibin and Kamishli, crosses the Jazirah plain and empties in the Khabur at Hassakeh. Its total length is about 100 kms. and its average flow is 3 cubic meters per second.

3121 In Turkey and Kamishli, the river has several beds. The Turks,
425 unable to exploit it fully in their country because of its short flow there, follow the practice of changing the river from bed to bed in the summer months, so that farmers in Jazirah do not know when the water will be available to them. This uncertainty has lead the villages which have a right to the water to sell their rights for one or more years to individuals on good terms with the Turkish authorities. These individuals in their turn bribe the Turks to direct the waters in the bed which leads to their lands. One family in particular has obtained a sort of monopoly on the waters of the Jagjag in Qamishli. The Asfar-Najjars buy the water rights from the villages for nominal sums and then try to reach an understanding with the Turks. Since they have one or two competing groups in Qamishli, the Turks usually get paid by both parties and satisfy none entirely. The Asfars manage however to get the biggest share.

3124 Such an unstable situation does not lead to steady irrigation
241 development along the lines of orchard planting. The farmer is lucky if he can grow one crop of rice or cotton with the present

fluctuations in water flow. Up to 1950, all the water of Jagjag was used for growing rice. In 1950-51, more emphasis was given to cotton. This year it is half cotton and half rice. 312 241

The Turks started a project for diverting all the waters of the Jagjag from Syria to Turkey. They began building tunnels to carry one quarter of the waters cast above Kubur el Bid, and the rest to the plains above Amuda and Dirbassiya. The Syrian Government objected and negotiations began in Ankara. The Syrians believe that they have reached an understanding with the Turkish authorities to divide the river waters equally. The Turks did not sign the agreement, claiming that they want a full agreement on water rights covering all common rivers and especially the Orontes. They are afraid that Syria might use all the waters of the Orontes in its irrigation projects. Since Syria holds this arm, the Jagjag dispute will be solved equitably. 312 648

It is difficult to estimate the area irrigated yearly by the Jagjag. The waters are used only for summer crops, and last year about thirty thousand dunums were planted to cotton. When the plantation is rice the area is nearer to ten thousand dunums. There is of course always a certain amount of land devoted to vegetable growing for the needs of the city. 312 241

d. Underground Water

Recently a few enterprising farmers tried to solve the problem of dependency upon Turkey for irrigation water by digging for water on their own lands. An Armenian outfit from Aleppo with a boring machine of local construction dug several wells in the region of Qamishli and Amuda. Three of the wells in the villages of Tal Ahmad and Tal Anbar near Kamishli were successful. Water to run a 4-inch pump was found at a depth of 18 meters. The other holes around Amuda were not so successful. Water was not found at a depth of 70 meters. These experiments are of course inconclusive and sufficient underground water may be found to be abundant in Jazirah. Further studies are needed. 312

a. The Khabur

The largest source of irrigation water in Jazirah is undoubtedly the Khabur. Its average flow is 52 cubic meters per second which 133

makes it the biggest river in Syria after the Euphrates. A short description of the Khabur valley was given earlier and the great possibilities of the river remain undeveloped. Unlike the Euphrates, especially in its lower reached, the Khabur valley is narrow. The alluvial plain does not extend more than five hundred meters on each bank in most places and then the land rises to a height of 10-50 meters over a distance of severl kilometers.

The alluvial plain along each bank has been more or less irrigated and planted by primitive methods such as the kard and the naqourah or dulab since old times. The kard can irrigate about fifteen dunums and the naqourah, if in good condition, can produce a flow of less than two inches of water and raise it to a height of a maximum six meters which is the diameter of the wheel. More prosperous Bedouins combine two or three naqourahs on the same axis and got a flow of about 3-5 inches. The naqourah is evidently a cheap way to raise water, but its construction is costly. Assuming that a Bedouin wants to build a naqourah on a new site, he has to erect a sort of a dam with stones on about half the river's width to raise the river's level and direct its flow towards his naqourah. Since stone is not abundant along the Khabur and has to be carried long distances, it becomes the job of specialized carpenters to construct the wheel, erect its supports, and balance it. This may cost another LS 1,500. The carpenter who constructs the wheel or naqourah becomes responsible for its maintenance and is paid yearly 11 percent of the yield of the land irrigated in lieu of wages.

The staple crops of the Khabur were formerly wheat in winter and sorghum in summer. Sorghum was preferred to every other summer crop because it provides food for both man and beast. Lately, the naqourah peasants began planting sesame and in the last two years cotton, but reverted this year to sorghum and sesame as the main summer crops.

Unlike the Kurdish or even the Bedouin peasant of northern Jazirah, the Khabur peasant is very poor and primitive. Rarely does he own one cow to use for plowing. Usually two or more farmers join to provide one team. For this reason the strip of land which he can cultivate for wheat or sesame does not exceed 20-30 dunums, of which half the yield goes to the owner of the land who provides water. This is to compare with 250-300 dunums cultivated by the Kurdish farmer, of which he has to pay only the rent of the combine for the harvest.

Irrigation by pump started with the rice boom in 1945 and expanded with the cotton boom of 1951. It was hit severly by the crop failure of last year and the flood of this spring, and the future of the Khabur appears dim. This is because as previously mentioned, the original amount of capital used to construct a fair sized project is large, amounting to about LS 150-200 thousand. Such a project can irrigate with two 10-inch pumps or their equivalent about 2, 500 dunums of summer crops and double the area in wheat and barley. The project will have one main canal 1 1/2-3 1/3 meters higher than ground level made entirely of earth or lined with cement to carry the water a distance of 1-3 kilometers depending on the lay of the ground, several subsidisary canals, buildings for the motors, the agricultural machinery, and the laborers.

Evidently, in order to get the best returns on the capital invested, the farmer needs to exploit to the utmost the capacity of his pumps, otherwise he will be leaving his capital idle. In this case, he will need to cultivate, on a rotation basis, 2, 500 dunums of summer crops and 5, 000 dunums of wheat and barley. But on most of the irrigation projects of the size mentioned, the area of the lands which can be irrigated is less than 1, 500 dunums in all. The surrounding lands are all higher than the main leading canal and can not be reached except by a much greater outlay of capital. This means that the farmer has to extract from an area of 1, 500 dunums, of which one-third lies fallow every year, enough profit in five to eight years, which is the average duration of the lease, to compensate him for his yearly efforts, to pay interest on the capital and to regain his investment. This should mean a net annual profit of about 45, 000 LS or LS 45 per dunum, and experience has proved that it can not be done.

The alterntive to pump irrigation on the Khabur is irrigation by gravity in works similar to that of Tal Mughass. And the Khabur lends itself in many places to such project. Mr. Delbes, agricultural advisor to Syria during the French Mandate, knows at least of three projects studied by the French High Commissariat, to build dams and derivation canals between Ras el Ain and Hassakeh. The largest one among them is to carry the water west to the region of Jabal Abdel Aziz and irrigate a very large area.

Another dam site studied by the French is at Sab'Skour. Further south in the region of Fadghami a site was selected to store the

3121 654 flood waters and distribute them in summer. All these studies, and it is not known how detailed they are, are believed to be kept at the French Legation in Beirut.

Such projects cost a lot of money, and Syria may not be able to construct them for many years. A quicker and less expensive policy is to combine elements from the system of irrigation by pumps and the system of gravity irrigation. This is the policy followed in Egypt, to dig canals conveying water from the river to areas ten or more kilometers removed and ten to twenty meters higher than the water level. Such dirt canals can be dug cheaply by modern machinery, and the farmers will then be authorized to install pumps on the canals. Since the greatest cost of an irrigation project is the construction of the main canal above the ground level, the method recommended removes the need for the elevated canals and the farmer can install his pump directly on the land to be irrigated. In this way, the farmer is spared also the loss due to evaporation and absorption on the elevated canal.

This is the quickest method to expand irrigated agriculture along the Khabur, and it may also prove in the long run cheaper to the country and the farmer than the elaborate dams and derivation canals contemplated by the Government. Such a conclusion needs, of course, more detailed engineering studies and comparison of costs before it becomes final.

## III. The Problem of Monoculture

243 Wheat and barley are by far the main crops of the Jazirah and with the exception of the Khabur valley, they are practically the only crops. What the irrigated lands of Kubur el Bid and Qamishli produce in summer crops does not compare in quantity or in value with the wheat crop.

243 571 For this reason, Jazirah suffers from all the defects of monoculture. When the wheat crop is good and the prices are high land values increase, the farmers are enabled to pay most of their debts and to raise their standard of living by building better residences, buying furniture, making more trips with their families to the interior cities of Syria and Lebanon, sending their children to schools in Aleppo and Beirut, and increasing their welfare in general. But

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# MALARIA, IRRIGATION, AND SOIL EROSION IN CENTRAL SYRIA

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THIS study of the Selemiya region of central Syria had its origin in a modest wartime public-health program. Hundreds of patients suffering from malaria in the villages of this district were regularly treated by a mobile clinic, and it soon became obvious that this work had to be supplemented if not replaced by swamp drainage and other measures of malaria control. The necessary investigations showed that soil erosion in the hills in the east of the region was partly responsible for the swamps on the plain. The swamps themselves were frequently associated with ancient irrigation works. Thus various problems of the region—agricultural, social, and medical—were closely linked in origin and development. It was found that attempts to solve any one of them alone could not be more than partially successful, and the conclusion reached was that the ideal solution would have to be radical, comprehensive, and on a large-scale regional basis.

## THE LANDSCAPE

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The greater part of the governmental subdistrict (caza) of Selemiya is a plain. Bounding it sharply on the west are low plateaus, capped by a level bed of basalt a few feet thick; to the southeast are ranges of hills, part of the Palmyrene group, to which the local collective name of Jebel Bil'as may be given.

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The ground slope over much of the region is toward the town of Selemiya; drainage from an area of 620 square miles converges on the low flat land around the town. Because of the continuous subsurface flow, a perennial stream rises at Ain ez Zerqa, to flow 12 miles to the west to join the Orontes. All other perennial streams, however, are only a few hundred or thousand yards long and are used for irrigation; most of them rise in artificial underground channels. Most of the watercourses are wadis, dry or nearly dry for much of the year. In the hills these are steep, V-shaped valleys, on the plain generally wide, shallow, gravel-filled channels in gentle, open valleys.

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Figure 2 gives a simplified indication of the configuration. Hydrologically, the strata may be simply grouped into the Cretaceous limestones

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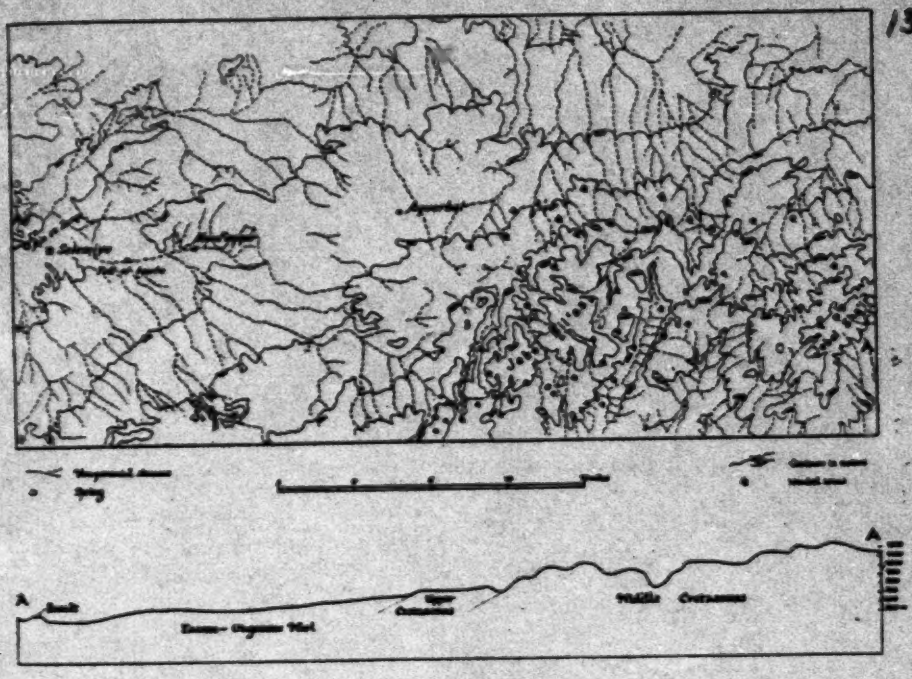

FIG. 2—Topographic map and cross section of the country east of Selemiya.

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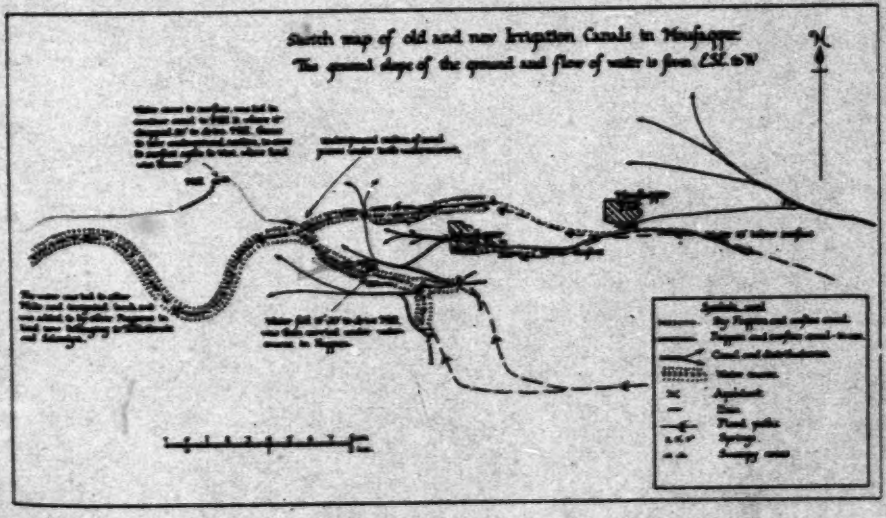


FIG. 3—The irrigation system of Moufaqqar, east of Selemiya (see Fig. 2).

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244 except wheat and barley, and around each village is an area of irrigated land on which vegetables, fruit, cotton, maize, fodder, and grain are grown. The configuration of the ground and the peculiar properties of the marl make possible the use of subsurface water for irrigation, and past and present inhabitants have taken full advantage of these conditions.

312 [406 371] Water is distributed to irrigation ditches from wells, surface watercourses, or *foggaras* (foqqaras).[2] It is lifted from wells either by pumps or by chains of buckets geared to an animal-turned wheel. From wadis which have water in part of their course for some or all of the growing season it is taken by a gravity canal. The stream is roughly dammed and the water led, at a gentler angle than that of the watercourse, along the valley side until it reaches a suitable level for watering the ground below. Neither of these methods is of great importance as compared with foggaras, which supply most of the irrigated lands of the area.

A foggara, known elsewhere as *qanat*, *kariz*, or "chain of wells," is an underground conduit. The method has been used since ancient times in many parts of the Middle East. Foggaras are found in several regions of Syria and are especially numerous in the Selemiya region. Figure 4 shows the general principle by which the water-bearing layer is tapped by the gallery or subsurface canal. The most copious supplies of water are provided when the canal is driven back from a spring along the underground "stream" that feeds it. A depression that is a natural gathering ground of water is often utilized, or a wide area may be tapped by the construction of several converging galleries, as in Mouloqqar. The gradient of the gallery is sufficient to induce water flow, but it is less steep than the general slope of the ground, so that water is conducted gradually to the surface, usually to low-lying flat land suitable for irrigation. The vertical shafts, like large wells, which connect the underground canal to the surface, were used during the digging as passages of ingress and egress and serve the same purpose now when the canals are cleaned of mud, debris, and vegetation; hence they are always surrounded with mounds of accumulated spoil. Lower down, as the canal comes to the surface, it flows between steep banks, which gradually become less high, until the water is flowing at ground level. Often the hardpan forms a natural roof to the gallery.

In length, depth, and water flow the foggaras differ greatly. One canal

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113 [2] Foggaras in North Africa have been described and illustrated in the *Geographical Review*. See John Blacker: Modes of Life in the Moroccan Countryside, Vol. 11, 1921, pp. 477-502, references on pp. 488 and 491; R. H. Forbes: The Transsaharan Conquest, Vol. 33, 1943, pp. 197-213, reference on p. 199—Edit. Note.

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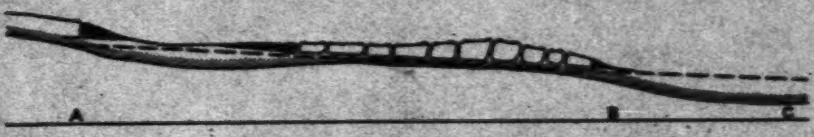


FIG. 4—Vertical section of a foggara. The diagonal shading represents the water-bearing level in the altered marl, below which is unaltered impervious marl. The gallery A to B taps the water-bearing layer at its upper end and in the center. Water in the gallery is represented by the dashed line. The irrigated area extends from B to C. The vertical shading represents the part of the canal between steep banks.

FIG. 5—Upper part of one of the Moufaqqar canals (see Fig. 3). Photograph from a position corresponding to B above, where the canal is formed by steep banks. Parts of natural roof are formed by the hard pan, clearly distinguishable from the bed of crumbly altered marl below. Until 1945 the canal was semi-derelict, filled with mud, vegetation, and flood detritus (see foreground). When the cleaning was completed, the canal was approximately doubled in depth and a strong stream of clear water flowed in the bottom. (Photograph by John Gough.)

was built, probably in the Roman period, to carry water from Selemiya to Apamea, more than 50 miles away. This was an exception, dug to carry drinking water to a city, but some of the canals which capture and supply irrigation water in the Selemiya plain are several miles in length; one, starting in Moufaqqar, was originally seven miles long. Others are only a few hundred yards in length.

The quantity of water delivered by the canals in use today is estimated

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locally by the area of land each irrigates. One canal irrigates 136 acres near Selemiya town; many supply between 20 and 60 acres; and the smallest suffices only for 2.4 acres (near Tell et Tout). The larger canals are nearly all in the low-lying basinlike plain around the town of Selemiya; most of the smaller ones lie toward the northeast. A canal which supplies 68 acres of land in Selemiya delivers 8.8 gallons a second (measured at lowest water level, in October, 1945). There are today in the caza 125 such canals which are in working order and an unknown number which are not in use. These 125 canals irrigate a total of 3060 acres. The map of Moufaqqar (Fig. 3) shows typical modifications and elaborations of the foggara.[4]

## History

At Misherfe-Qatna, where a modern village occupies the site of a Hittite fortress-city, 18 miles southwest of Selemiya, a foggara-like canal supplied the town in the second millennium before Christ.[5] Most of those in our region date from a much later period, and probably more were constructed from the second century of our era to the sixth than at any other time. Many can be dated by the details of their construction, or by their close association with ruins, or, occasionally, by inscriptions. During these centuries the Selemiya region was a prosperous agricultural district, well supplied with irrigation water. The Roman legacy was added to in the early period of Arab rule,[6] when Selemiya was well known as a pleasant country town, the public buildings of which, especially the baths, rivaled those in great Arab cities. Descendants of the Abbasid Prince Saleh ibn Ali ibn Abdullah ibn Abbas ibn il Motalib lived in Selemiya, and, according to Ya'qubi, writing in 891, Abdullah, the son of Saleh, "conducted thither a stream of water, and dug wells in the land, whereby the saffron grows plentifully." For a period after 893 the town became a center of the Ismaili sect, a circumstance which brought it importance then, and which was to affect the region powerfully a thousand years later.

Throughout the Arab period the water of Selemiya remained famous. As late as the fourteenth century Ahmed the Secretary praised Selemiya as "a charming and rich town, with abundant water and trees. Water comes

[4] See the maps of Qdeym for typical modifications and elaborations of the foggara. Plate III and IV in the atlas volume of R. Mouterde and A. Poidebard: Le limes de Chalcis: Organisation de la steppe en Haute Syrie romaine (Bibliothèque Archéologique et Historique, Vol. 38), 2 vols. (text and atlas). Paris, 1945. See review elsewhere in this number of the *Geographical Review*.

[5] Menail du Buisson: Le site archéologique de Michrife-Qatna, Paris, 1935.

[6] Information on the Arab period is drawn largely from the article "Salamiya" in the Encyclopaedia of Islam and from Guy le Strange: Palestine under the Moslems, Boston and New York, 1890. The quotation from Ya'qubi is from Le Strange, p. 528.

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to it in aqueducts."[7] Today there are 39 foggaras in use on the lands of Selemiya, and there are also some that are unused. Very few of the foggaras are modern, so that we may legitimately suppose about the same area to have been irrigated around the town in the Arab period as at present—1300 acres. The water was renowned for its purity, as it is today, and Hama, 18 miles away on the muddy Orontes, drank Selemiya water brought to the city by a foggara from Ain ez Zerqa. Abu el Fida (1273–1331), geographer and king of Hama, caused this canal to be cleaned, and two centuries later the following inscription from a Hama mosque shows that it was repaired or cleaned again:[8]

On fifteenth Gumada I 901 [March 2, 1496] was promulgated the princely, august decree of our master, the great emir, the chief, the governor general, Sayfiddin el Asrafi Qansuh as Sarifi as Sami, governor general of the province of Hama (may God glorify his victory!), prohibiting the diversion of moneys to the profit of the exchequer (may it ever prosper!) and of others, from the funds intended for the aqueduct of Selemiya, and ordering that nothing should be taken from this fund except the wages of the workmen laboring on it. Whoever should renew these exactions, let him be accursed, and may both his father and his Prophet testify against him on judgment day.

By this time the prosperous days of Selemiya were nearly over. Scattered references show that the frontier of settlement and regular agriculture in the region was retreating westward. Tamerlane ravaged all Syria in 1400, and in 1516 the country fell to the Turks. During the next four centuries Syria slowly decayed. In the seventeenth and eighteenth centuries several great Bedouin tribes moved north out of Arabia into the Syrian Desert and its peripheral regions. After this the steppe and the desert were almost completely beyond the control of the Turkish government, and the frontiers of law, order, and settled life retreated from the edges of these uncontrolled territories. The valuable journals of some English merch..ts[9] who traveled through the eastern part of our region at the end of the seventeenth century show that, except for Bedouins, it was then practically deserted. The Ismaili inhabitants, according to their descendants' tradition, had left soon after

[7] See [Maurice] Gaudefroy-Demombynes: La Syrie à l'époque des Mamelouks (Bibliothèque Archéologique et Historique, Vol. 3), Paris, 1923, pp. 77–78.

[8] This inscription is from the Great Mosque of Hama, where there are a number of Mameluke decrees, dealing particularly with trade and taxation. It is transcribed in French by Jean Sauvaget in *Bulletin d'Études Orientales de l'Institut Français de Damas*, Vol. 3, 1933, p. 6.

[9] "An Extract of the Journals of Two Several Voyages of the English Merchants of the Factory of Aleppo, to Tadmor, Anciently Call'd Palmyra," *Philos. Trans. Royal Soc. of London*, No. 218, Vol. 19, 1695, pp. 129–147. [Also in "Miscellanea Curiosa," Vol. 3, Containing a Collection of Curious Travels, Voyages, and Natural Histories of Countries, As They Have Been Delivered in to the Royal Society, 2nd edit., revised and corrected by W. Derham, London, 1727 (originally edited by Edmund Halley in 1708), pp. 120–159.]

7:Lewis S-5 (ca. 1940-45) 1948 MD1 Syria MD1



175 Tamerlane's invasion and were dispersed in other parts of Syria. Of 3200 villages once on the tax rolls of the pashalik of Aleppo, only 400 were said to be inhabited when Volney visited the country in the 1780's.[10] Such peasants as remained in the west of our region suffered from misgovernment, extortion, and raiding by Arab tribes.

166 In the second half of the past century a movement of recolonization [231] started that is still in progress. Sheep-raising Arab tribes began to settle in 361 villages; peasants came from the districts of Hama and Homs; immigrant 795 Circassians established four villages north of the town of Selemiya. The ● 312 frontier began to move outward once more, and old foggaras were cleaned 241 and repaired to give irrigation water once again. The strongest and most energetic immigrant group, the pioneers, were Ismaili, led back to their land of a thousand years ago by a group of powerful leaders. They settled first on the site of Selemiya itself about 1870. Today they number 14,000 or more, the majority living in the town and in villages to the east. They chose village sites where old foggaras could be brought into use, and for 75 years they have been extending the area of irrigated land by the restoration of old canals and the digging of new ones. In the last 20 years subsistence agriculture, depending largely on unirrigated grain farming, has given way before a more intensive commercial system, typified by the growing of irrigated cash crops such as seed onions and cotton on individualized holdings [457] The government has granted money for canal cleaning and swamp drainage. All these factors have contributed to extension of irrigation.

312 Some old canals, however, are still derelict. Some are so ruined that the [464] cost of repair would be prohibitive. Others may yet be brought back into use, but the will to work is weaker than in the early days of colonization, and now laborers' wages and other expenses have increased. Elsewhere village boundaries cut across old canals. Landowners of the village where a canal rises are loath to let the water flow away to the lands of another village, and thus ancient foggara systems which were perfectly related to the physical environment have been partly replaced by more local schemes of surface canal and ditch irrigation. For example, the canals that rise in Moufaqqar (Fig. 3) could irrigate land and drive mills in Moufaqqar, Tell et Tout, and Selemiya, but they have been so modified that the water is used only in Moufaqqar, and some of it runs to waste. A canal which rises in Tell et Tout but which formerly flowed on to Selemiya land has been blocked, so that its water irrigates Tell et Tout land only.

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113 [10] C.-F. Volney: Travels through Egypt and Syria, in the Years 1783, 1784 & 1785, translated from the French, 2 vols., New York, 1798; reference in Vol. 2, pp. 90-91.

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## Malaria and Its Control

Foggaras and surface canals easily become partly blocked by vegetation, and floods and rain wash in mud and silt. The water is then ponded back, depressions near the canal bank fill, the canal may overflow, and, if it is built along the side of a valley, overflow or seepage will maintain swamps along the watercourse. Artificial blockages of foggaras also pond back the water. Near the lower end of most canals are "brick pits" from which earth has been taken to be made into mud bricks, and these also tend to fill with water. Everywhere wadis carry rain and seepage water in winter and spring and the overflow from irrigation canals in early summer and autumn, at which seasons there is a surplus. In other words, except during the peak irrigation and evaporation period of midsummer, they carry slow-moving, half-stagnant water.

All these places are potential, and most of them actual, breeding places of the mosquito *Anopheles sacharovi*, which favors shallow, sunny, warm waters, full of aquatic vegetation. At only one place in the area has another malaria carrier, *A. algeriensis*, been found, and the problem of malaria control in the region is thus essentially that of eliminating the *A. sacharovi* breeding grounds. Full statistics are not available, but such figures as do exist show the great need of such control. About 20 per cent of the patients treated by a mobile clinic in the region in 1942–1945 were suffering from malaria, and the percentage rose at times (especially in late summer) to 80 in some villages. Sometimes practically the whole population of a village was found to be infected. In Tell et Tout (population *c.* 550) about 50 deaths were due primarily to malaria in 1941, and almost the sole source of infection was the swamp caused by the deliberate blockage of a foggara.

Control work is apparently simple. Canal owners occasionally clean the canals of detritus and vegetation and repair the banks at the lower end. It is important that this work be done well and repeated every few years. Small depressions may be sprayed, filled with earth, or drained by a simple ditch. Broad, sluggish streams may be canalized by a ditch along the thalweg. The more efficient the irrigation, the less likely it is that mosquitoes will breed. Waste of water should be reduced to a minimum and a wide range of crops grown, so that irrigation begins early in the season and ends late. The "waste" water of natural watercourses may be utilized by the construction of a simple dam and gravity canal, or by the repair of the old subparallel foggara if, as is probable, there is one. Extensive stretches of swampy ground may be put to good use by drainage-irrigation schemes, which often include the repair of old foggaras. Malaria control should not stand on its own, an expensive

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necessity for health's sake alone, but should be part of a general *mise en valeur* of the region's resources. This is the type of approach which is most likely to succeed, because it is linked with the material interests of the landowners. They will lend their support and active participation if given technical advice, supervision, and material and financial help to defray part of the capital outlay.

## Swamps, Floods, and Soil Erosion

Malaria-control measures were taken with a fair degree of success in 20 villages in 1944–1945. Various factors, however, combine to prevent a permanent reduction of the incidence of the disease. Among these are the necessity for constant supervision, the need for repeated cleanings of canals and ditches, and the improvidence of the inhabitants. Most important is the fact that floods will certainly undo much of the work.

Winter floods are frequently heavy enough to destroy or damage seriously the repair and maintenance works, which are of value to agriculture and malaria control alike. Malaria causes debility and apathy among the villagers, and the certainty that floods will recur reinforces this apathy, making everyone disinclined to expend energy and money in work which must be done again in a few years. The canals and watercourses at Moufaggar, for example, have been badly damaged in the past; in fact, damage by floods was the main reason for the modification of the old foggara system. The southern foggara and watercourse are now protected against torrents by a concrete wall at the upper end, but as the system lies in one of the main valleys coming from Jebel Bil'as, it is doubtful whether the device will be a great success. Although the broad, nearly flat valley north of Selemiya has benefited from its wide catchment area—it is built up of alluvium, as much as 10 feet deep—it is partly derelict because floods have created extensive swamps and ruined old foggaras. In 1945–1946 useful drainage work was undertaken here.

The floods are due in part to the occasional sudden and torrential rainstorms, characteristic of this as of other semiarid regions. Wadis are sometimes filled for a few hours with violent, detritus-laden torrents and are then left dry again. The steep slopes and absorptive limestones are contributing factors. English merchants, traveling in 1691, noted[11] that after a heavy rainstorm

> those hollow Gutts which we passed over without the least appearance of Moisture, were, by the Cataracts which descended from the Mountains, become Rivers; . . . the next Morn-

[11] "An Extract of the Journals" (*op. cit.*), p. 144 [Miscellanea Curiosa, pp. 139–140].

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## II IRRIGATION AND RECLAMATION

The extension of irrigated land is of vital importance in a country like Syria, where large potentially fertile areas yield little or nothing because rainfall is inadequate and where nearly all of the cultivable area produces no summer crops because no rain falls from spring to autumn. It has become even more imperative with the shrinkage in the area of good rainfed land which can still be taken under cultivation. Thus irrigation is the principal means for expanding the cultivated area, increasing and stabilizing yields and diversifying agricultural production by developing summer crop cultivation.

### *Existing Irrigated Areas*

At present about 400,000 hectares of land are probably already under irrigation. Of these, approximately 250,000 hectares are irrigated by pumps drawing water principally from rivers but also from wells. Most of the river pumps are located in the valley of the Euphrates and its tributary, the Khabour, while by far the greater number of pumps drawing on underground water is in the provinces of Hama and Aleppo. Except for small areas still supplied by animal-driven *norias* (water wheels), the remainder is irrigated by gravity flow from rivers, springs and *foggarahs* (underground ducts). Only 48,000 hectares are covered by government irrigation schemes, including the Homs-Hama scheme providing a rather inadequate supply of water from the Homs lake to 22,000 hectares; the Mzerib project in the Hauran, which irrigates 2,500 hectares from the springs feeding the Yarmuk river; the Tell Maghass scheme on the Khabour, which provides for 8,500 hectares but is not completed; and the Matkh project covering 15,000 hectares south of Aleppo, which receives a wholly inadequate supply of water from the Kouek river during the dry season when most of the water in the upper reaches of the river is taken by Turkey for irrigation.

The possibilities of additional irrigation are by no means limitless. Except for the Euphrates, Syria has no large river with a substantial flow during the summer dry season. In fact the Euphrates accounts for 83% of the aggregate annual flow of Syria's rivers. Thus the available water supply may set a limit of 400,000 to 600,000 hectares on the additional area which can be irrigated. In the last analysis, however, the upper limit will be determined by the division of the Euphrates water with Iraq, which is in the

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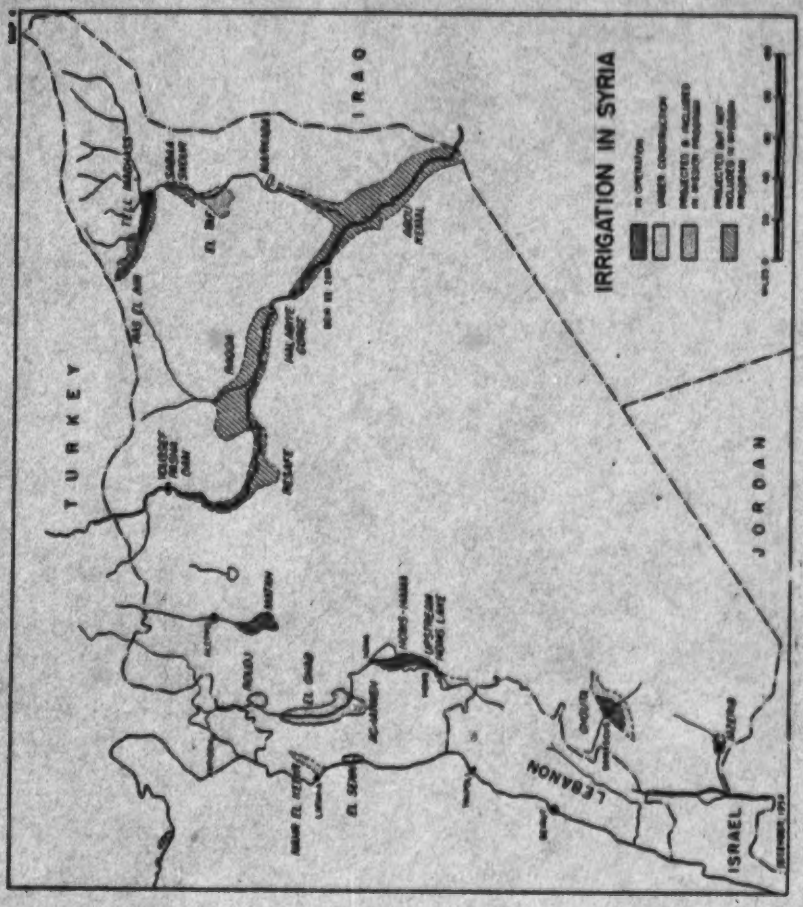

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312 process of expanding considerably the area irrigated from that river.

Government projects based on the use of river water will have to be the principal means of extending irrigation in the future. Private pump irrigation from rivers or wells cannot be expected to increase rapidly. Additional privately operated pumps could in theory put more land under irrigation, but the land still available for such irrigation would for the most part require higher-lift pumps which are much more expensive to operate. In fact, few new pumps have been installed in the last few years. Moreover, the extension of private pump irrigation on terms which are very burdensome to cultivators appears socially undesirable. Nor is the prospect of expanding irrigation with underground water, particularly through wells, very promising. Underground water in the drier areas of the country is quite limited in supply and often contains harmful sodium and magnesium salts. More extensive investigation of underground water is unquestionably needed, but this should focus in the first instance on finding adequate supplies of drinking water in such areas as the Hauran and Djebel Druze where supplies for human consumption are seriously inadequate and in the Syrian desert where water for livestock is sorely needed. The many wells sunk in certain parts of the country have generally been shallow and have, in one district at least, tended to lower the water table; and the extension of wells to deeper water-bearing strata capable of providing a more plentiful and stable supply may well entail such a heavy investment and high operating costs as to be justified only for crops, such as vegetables, having a high return per hectare.

*Completion of Projects Under Way*

312 653 Any program must, of course, provide for the completion of government projects already under way. Tell Maghass remains unfinished even though it has been under construction for 10 years, and it is imperative that the remaining part of the canal system be completed rapidly and that the necessary funds—£S 4 million—be provided. The El Senn project, designed to irrigate 5,000 hectares south of Latakia, is over half finished. In the Roudj, a swamp of about 4,000 hectares in Aleppo province, facilities for drainage have just been completed, but an irrigation system must still be planned and laid out. The completion of the latter two projects will require a further expenditure of about £S 4 million.

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*Reclamation of the Ghab*[7]

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By far the most ambitious project undertaken by the government is the reclamation of the Ghab. This large marsh, stretching north and south along the borders of Latakia and Aleppo provinces, was created by the Orontes river whose flow has been impeded by the existence of a hard basaltic sill at Kfarie. The plan is to reclaim an area of 35,000 hectares by lowering the sill, deepening the river bed and constructing a network of drainage canals. Two reservoirs to be constructed at Halfaya and Rastane will regulate the flow of the Orontes river and store water sufficient to irrigate not only the Ghab, but also the Acharneh plain—a total area of 65,000 hectares. However, of this area, 22,000 hectares are now irrigated by pump. The permanently submerged part of the Ghab—some 29,000 hectares—belongs in the public domain and will after reclamation be available for distribution among settlers drawn from landless or virtually landless peasants in nearby areas.

The cost of the project was originally estimated at £S 136.5 million including £S 8.5 million for interest during construction, £S 38.2 million for a main road through the Ghab and £S 2.65 million for the construction of a central village. A recent special study sponsored by the International Bank indicates, however, that this estimate will probably have to be increased to about £S 171 million. Because of the numerous works which must be constructed in successive stages, the whole project is unlikely to be completed before 1965. As the drainage works progress, however, new land, totaling 10,000 hectares by 1960, will gradually become available for cultivation. The first stage of the construction work—the lowering of the sill—was begun in the latter part of 1954.

*Other Irrigation Projects*[8]

In selecting other irrigation projects which might be carried out over the next five or six years, the mission was beset by many difficulties. With one exception, all the projects considered were only in the conceptual stage. Exact data on the areas which might be irrigated by each project, or on the quality of the soils of the irrigable land, were for the most part unavail-

[7] See Annex D, p. 327.
[8] See Annex D, p. 330.

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able. With one exception, detailed planning of the various projects had not been undertaken. 312 453

Nevertheless, the mission believes it necessary to recommend a tentative program subject to alteration upon the completion of more detailed studies. In selecting projects for inclusion in this program the mission has taken into account not only the indicated relationship of cost and benefits, but also the location of the projects and the relative needs of various parts of the country.

### 1 EUPHRATES VALLEY SCHEME

The Euphrates river undoubtedly offers the greatest possibility of extending the irrigated area in Syria. At present, however, a considerable amount of water is already used for pump irrigation; if much more is to be withdrawn it will be necessary not only to reach an agreement with Iraq regarding the division of the water but also to provide facilities for the storage of water during the flood season. A project for a storage dam at Youssef Pasha has already been worked out; this would increase the minimum flow of the Euphrates during the dry season from about 300 cubic meters per second (m 3/sec) to around 400 m 3/sec. With a long canal starting from the dam it may be possible to irrigate about 185,000 hectares of the so-called Raqqa plateau on the left bank of the river and approximately 54,000 hectares in the Resafe area on the right bank. In addition, the construction of a diversion weir at the Halabiye gorge between Raqqa and Deir ez Zor would probably permit the irrigation of 165,000 hectares farther down in the Euphrates valley. Of the total area thus to be irrigated by projects dependent on the Youssef Pasha dam—404,000 hectares—over one-third or approximately 152,000 hectares are already irrigated by private pumps.

For a number of reasons the mission has reluctantly concluded that this entire group of projects should be deferred until after 1960. First of all, the capital investment required is very large and the benefits will not accrue for a long time. The Youssef Pasha dam itself would cost £S 150 million and the irrigation works would entail an additional outlay of probably £S 560 million. The dam could hardly be completed before 1963, and the construction of all the irrigation works would probably take longer even if it proceeded simultaneously. The financing of the Euphrates and Ghab projects at one and the same time would impose an excessive

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burden on the resources available to the government; and it would require substantial expenditures over a long period without an attendant increase in production, thus leading to inflationary pressures.

The second reason for deferring the Euphrates projects is the fact that much preparatory work must in any event be undertaken before they can be launched. Estimates of the areas that can feasibly be irrigated must, for example, remain largely conjectural until topographic and soil surveys and land classification can be undertaken. Plans for the irrigation systems should not be drawn up until experiments are carried out to determine the proper irrigation duty (i.e., water to be used per hectare) in the light of soil conditions and projected cropping patterns. While plans for the Youssef Pasha dam have already been drawn up, additional borings to explore the foundation conditions of the dam are still necessary. The mission recommends that all this preparatory work be undertaken over the next few years and it has included £S 3 million in the program for this purpose. Meanwhile the government should also seek to reach an agreement with Iraq regarding the allocation of the Euphrates water.

## 2 RECOMMENDED PROJECTS

The mission would perhaps be more favorably inclined toward an early start on the Euphrates projects if there were no other possibilities of expanding the irrigated area. But there are a number of small projects which can be undertaken at a lower cost and can be completed more rapidly. After considering the various possibilities, the mission recommends that the following schemes be carried out in the years 1955-60:

| Project and location | Estimated cost (in million £S) | Area to be irrigated (in thousand hectares) | | |
|---|---|---|---|---|
| | | Total | Newly irrigated | Already irrigated |
| Mzerib, in the Hauran | 8 | 4.6 | 4.6 | 0 |
| Nahr el Kebir, in Latakia | 15 | 4.0 | 3.5 | 0.5 |
| Barada, near Damascus | 30 | 15.0 | 15.0 | 0 |
| El Taf, on the Khabour | 30 | ca.20.0 | ca.10.0 | ca.10.0 |
| Total | 83 | 43.6 | 33.1 | 10.5 |

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The first of these is really an extension of the existing Mzerib project and calls for the irrigation by pump of 4,500 hectares with water from the springs at the headwaters of the Yarmuk. It is the only project ready for immediate execution and has the advantage of extending the irrigated area in a province which suffers from a chronic shortage of water.

The Nahr el Kebir project is included despite its rather high cost because it is a multiple-purpose project with diverse benefits. It involves the construction of a storage dam on the Nahr el Kebir, which will not only serve irrigation but also control periodic floods and supply water and power to the growing port city of Latakia.

The Barada river project entails the construction of two dams—one at Hameh and the other farther upstream near Makaren—to provide water for both power and irrigation. This scheme appears particularly attractive because it would permit the irrigation of 15,000 hectares of good land in the vicinity of Damascus, an area of dense population, and would help to meet the growing power needs of the nation's capital.

The El Taf project requires the construction of an earth fill dam across the Khabour river on the site of an old Roman dam. The water thus diverted might irrigate about 10,000-15,000 hectares on the right bank, and 6,000 hectares on the left bank of El Taf river. The land in this area is rather good but cultivable only if irrigated. While there are other possible projects on the Khabour, the mission considers all of them less promising. Farthest upstream and south of Ras el Ain, some 20,000 hectares could be irrigated, but this is in an area of relatively abundant rainfall where winter crops can be grown without irrigation and where landowners are already installing pumps at their own cost for summer irrigation. The Saba Skour project, 12 kilometers downstream from Hassetche, could irrigate about 15,000 hectares, but the dam which would have to be constructed would flood a considerable area of rich alluvial land now under cultivation. Farther downstream from El Taf, additional irrigation would probably be feasible only if the limited supply of water available in the Khabour during the dry season were supplemented by storage during the flood season. The only possible site for a storage dam appears to be at Markada; but a dam in this location would have to be very long and would provide only a very shallow reservoir with attendant dangers of excessive evaporation and silting. The feasibility of the Markada dam should first be carefully investigated.

If the new projects recommended above are carried out and those now

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312 under way are completed, Syria would have under irrigation an area of
653 89,100 hectares additional to that already irrigated. Certain projects, including the Ghab, Barada and El Taf, will, of course, not be completed in the period 1955-60 covered by the mission's suggested program. Under that program, the total newly irrigated area will have increased by about 40,000 hectares by the end of 1960.

*Planning of Irrigation Schemes*

312 The planning, construction, maintenance and operation of all irriga-
653 tion projects (except the Ghab for which a special office has been created)
647 is the responsibility of the Hydraulics Branch of the Ministry of Public Works. At present the staffing of this branch is far from adequate to carry out a greatly expanded program. While the technical staff is supposed to number 78, including 19 engineers, the number actually employed is only 36, of which 11 are engineers. Temporary appointees totalling 23 bridge only part of the gap. The staff must ultimately be greatly expanded. It will take time, however, to train additional technicians; and the goal will never be reached unless the present inadequate salary scale is raised so as to attract competent recruits. Meanwhile, the Ministry will be unable to carry out the suggested irrigation program unless it utilizes every opportunity to delegate the planning and execution of projects to properly qualified private firms.

In discussing the Euphrates projects, the mission has already emphasized the importance of adequate planning and recommended the allocation of £S 3 million for the necessary preparatory work. Part of this sum should be used for the construction of a hydraulics laboratory which would be useful in testing models of all proposed irrigation structures. Through model testing it will be possible properly to design such structures as weirs, canal intakes and sluices so as to anticipate subsequent damage and to achieve maximum economies in construction. It would also be highly desirable to experiment with different types of canal linings. The concrete linings used up to the present are expensive and not wholly satisfactory. It may be possible to use the asphalt available in Syria to devise a lining which would neither crack nor be too fluid and would at the same time be more economical. The mission urges that a qualified foreign firm be engaged to make laboratory tests with this material under conditions simulating those in Syria.

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*Recovery of Costs*

The capital cost of irrigation and reclamation schemes can and should be recovered from the beneficiaries. In principle it makes little difference how these costs are recovered—whether through sales of government-owned land that is reclaimed or irrigated, through improvement levies on newly irrigated privately owned land, through irrigation dues, or through a combination of any of these. The state should, however, appropriate most of the benefits for the community at large and to this end impose levies on the direct beneficiaries proportionate to the benefits derived. This is not only socially equitable but it enables the government to recover the cost as rapidly as possible and thus acquire the means to undertake additional projects. The direct beneficiaries must, of course, be allowed to retain some of the benefit, but there is no justification for allowing private landowners whose land is irrigated by the government to enjoy a windfall or for settling farmers on newly irrigated or reclaimed land on terms which enable them to live on a standard far exceeding that of their counterparts elsewhere in the country.

In the past the government has sought to recover the cost through irrigation dues. In 1953 the government collected on this account £S 473,000, which left a margin of £S 268,000 over the amount appropriated to maintain existing irrigation schemes. Early in 1954 the government introduced a new scale of charges increasing progressively with the size of the landholding. The prospective yield of these charges is difficult to assess. While the scale takes into account differences in the benefits accruing from various schemes, the mission considers that the fees instituted for the Tell Maghass, Mzerib and El Senn projects, while higher than those in others, are still rather low in proportion to the benefits enjoyed by cultivators and landowners. A review of these charges therefore appears desirable. If and when the government adopts the mission's recommendation for a progressive land tax, the progressive feature of the irrigation charges may also have to be modified.

*Maintenance*

Adequate provision for maintenance of irrigation schemes after completion is, of course, essential. Current appropriations for maintenance appear rather low. In 1954 they were raised to £S 350,000 from a total of

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312 652 £S 205,000 the year before, but even this amount provides only a little over £S 7 per hectare. The mission suggests that the maintenance allowance be increased gradually to £S 10 per hectare.

*Water Conservation*

312 While new irrigation schemes must obviously be carried out, it is also important that measures be taken to ensure that the limited supply of water available on existing irrigated areas is used to maximum advantage. Much water is being wasted because of inadequate knowledge of irrigation techniques and of the water requirements of various crops in different parts of the country. The mission has already pointed to the necessity of undertaking certain experiments to determine the appropriate irrigation duty as part of the preparatory work for the Euphrates irrigation projects. Quite apart from this, the Ministry of Agriculture in cooperation with the irrigation service should launch a series of experiments to determine the appropriate irrigation duty and irrigation techniques in areas which are already being irrigated. Such experiments, for instance, might well show that furrow irrigation makes better use of the available water supply than the customary basin irrigation. Demonstrations in water conservation might also be usefully undertaken. The mission has noted, for example, that improved levelling of land would produce a much more economical distribution of water. It is also evident that farmers in many places can be assisted in initiating small irrigation schemes of their own by storing runoff water in simply constructed catchment basins. To start work along these lines, the mission recommends a total expenditure of £S 1.2 million in the period 1956-60.

*Proposed Outlays*

312 652 The commitments already undertaken by the government and the additional recommendations made by the mission would entail a very large increase in expenditures on irrigation and reclamation. The cost of the proposed program is shown in Table 5. The mission firmly believes that the projected outlays are necessary and can easily be justified by the increase in production that will be achieved.

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TABLE 5 Expenditures on Irrigation and Reclamation, 1950–60

(*Thousand £S*)

| | Past outlays | | | Future outlays | |
|---|---|---|---|---|---|
| | 1950–52 average | 1953 estimate | 1954 estimate | 1955–60 total | Annual average |
| Projects—total | 2,368[a] | 3,130[a] | 3,380[a] | 197,000 | 32,833 |
| Completion of works | — | — | — | 9,000 | 1,500 |
| Ghab | — | — | — | 102,000[b] | 17,000 |
| Other new works | — | — | — | 83,000 | 13,833 |
| Euphrates valley studies | — | — | — | 3,000 | 500 |
| Maintenance | 113 | 205 | 350 | 3,000 | 500 |
| Research and demonstration | — | — | — | 1,200 | 200 |
| Grand total | 2,481 | 3,335 | 3,730 | 201,200 | 33,533 |

[a] Budgetary and extrabudgetary expenditures. The 1954 total excludes an £S 5 million authorization for the Ghab of which probably only a negligible portion was spent.

[b] After allowance for receipts from sale of land and water.

## III LAND POLICIES AND LAND SETTLEMENT[a]

A fuller knowledge of the available land resources is essential not only to plan better utilization of land already under exploitation, but also to determine how much land remains for expansion of cultivation and what must be done to make it productive. Even the existing pattern of land utilization is hardly known. Data on the total cultivated area, on the acreage planted to individual crops and on production are at best only rough estimates which are often quite wide of the mark. Little is known as yet about various types of soils, their deficiencies and potentialities. Widely varying opinions are expressed regarding the area which can still be put to the plow or can be irrigated by gravity flow.

### *Aerial Survey Program*

Aerial photography can be of great assistance in planning land utilization and public works of importance to agriculture. Up to the present it

[a] See Annex E, p. 351.

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1960, or an annual average of around £S 14.3 million over the period 1955-60.

The principal task of the central government in this field will be to assist towns and villages in obtaining adequate supplies of pure drinking water. Now that the expensive new system for Aleppo is virtually complete, it should be possible to devote more resources to the smaller cities and villages. Some £S 5 million will still need to be spent on expansion and improvement of the distribution network in Aleppo. Aside from this amount, we recommend that the government allocate about £S 8 million over the period 1955-60 for water supplies in towns and villages. The government has recognized that the problem is most acute in the Hauran and the Djebel Druze. Much of the population in these provinces is dependent on rain catchment for its water supply, and supplies in catchment basins quickly become polluted and occasionally dry up. The problem in these regions is complicated by the dearth of underground water, which necessitates expensive geophysical surveys. Elsewhere in the country there are still many villages and towns which urgently require pure water. For example, Hassetche, although the capital of Jezireh, is dependent on water drawn directly from the Khabour river and peddled from carts in the city streets. Because the need is so great, funds for water supply will have to be used with great economy. Extensive distribution systems which are expensive to install and maintain must be avoided. In the smaller villages a centrally located well will generally suffice. For the larger villages and towns the water should be piped to a limited number of public fountains where inhabitants can draw it for their domestic needs.

Waste disposal is also an important problem, especially from the standpoint of public health. Even the larger cities have not fully solved this problem. In Damascus, for instance, the sewers empty into the Barada river, whose water is used farther downstream not only for irrigation but also for drinking. The most immediate need, however, is for proper waste disposal in the villages. The construction of latrines and cesspools appears to be the only feasible solution there, and the community self-improvement program which, in accordance with our earlier proposals, would be initiated by community workers, should focus at least in part on the improvement of village sanitation by this means. To overcome any public inertia, the government might find it advisable to give squatting slabs or some comparable assistance to householders as an incentive to construct and use latrines.

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## VI IRRIGATION TECHNIQUES

Even when the irrigation program gains momentum, water will remain one of the principal limitations on agricultural expansion. Optimum water utilization requires making the most of available supplies and avoiding waste, as well as limiting cultivation in irrigated areas to those crops which need irrigation.

### *The Use of Water*

At present, farming techniques are such that in many areas large quantities of water are wasted, particularly by surface evaporation,[7] and only rarely is the water evenly distributed over the land. Development of the best irrigation techniques (such as furrow irrigation) for the soils of the various regions clearly requires the establishment of research and demonstration sections in the agricultural stations existing or recommended for the various localities, for the farmers will rarely adopt new methods unless they can see the benefits at first hand.

### *Crop Restriction*

Since the quantity of water is limited, it is equally important that irrigated fields be reserved for those crops which will derive most benefit. Conversely, crops such as cotton and rice, whose cultivation is hazardous under dry-farming conditions, should as far as possible be grown only on irrigated areas; sugar beet also requires irrigation in areas where the rainfall is less than 600 mm. A licensing system already exists with regard to cotton cultivation and it is important that it be enforced. In the long run, however, the farmer himself should be able to assess the profitability of crops grown under various conditions. The demonstration stations mentioned above should therefore be equipped to show how different quantities of water affect a variety of crops. To assure year-round utilization of land in irrigated areas (as elsewhere) farmers must also be educated in the use of soil-replenishing crops which will at the same time profitably replace fallow.

[7] Conversely, many farmers do not know how to drain their land when there is too much water.

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# ANNEX D *NOTES ON IRRIGATION*

## 1 THE GHAB PROJECT

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The Ghab valley, part of the Orontes river valley, is about 50 kilometers long from south to north and about 10 kilometers wide. There is in the valley a marshy area of about 35,000 hectares, which cannot be cultivated at present, although it consists mostly of good alluvial soil. If drained and irrigated the reclaimed land would probably be suitable for rice, cotton, sugar beet and pulses as summer crops, and wheat, barley and winter vetch or clover during the winter. It has the great advantage of being near both the important domestic market of Aleppo and the port of Latakia, permitting ready export of products in excess of local needs.

The marsh would be drained by excavation of a basaltic sill at Kfeir that now prevents the out-flow of water, and by construction of a system of drainage canals. Included in the area to be developed for agricultural use is the Acharneh plain just upstream from the Ghab valley in a bend of the Orontes. The Orontes river is now unable to drain the plain because its bed has been raised by silting. An extensive network of irrigation canals would be constructed for the irrigation of the plain and the valley. Including the reclaimed land, the total irrigated area would be about 65,000 hectares. A reservoir with a storage capacity of about 68 million cubic meters would be constructed behind a dam near Halfaya to control the Orontes flood, and a second dam located near Rastane would provide a reservoir of about 180-265 million cubic meters for irrigation purposes. About 20,000 KW of electric power would eventually be developed in hydroelectric plants at Rastane, Maharda and Jisr ech Choghour. The last two plants, however, could be operated only during the off-season for irrigation.

Of the 65,000 hectares, 43,000 have not previously been irrigated and of these 29,000 hectares are government-owned. The project would further provide for the settlement of a large number of farmers in the latter area.

It is anticipated that completion of the entire project will require about 10 years, proceeding in overlapping stages as follows: (a) drainage of the Orontes valley; (b) the Halfaya flood control dam; (c) a part of the road system; (d) a soil improvement program; (e) about 75% of the irrigation

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312 network. If an early start is made on (a), (b) and (c), then the soil im-
653 provement program and irrigation network might be initiated in 1956 and
185 1957 respectively.

The later work, mainly in the Acharneh plain, will be done after 1960. It will include drainage of the plain, construction of the Halfaya tunnels, completion of the road system, construction of the irrigation network of the Acharneh plain and Rastane dam, and the relocation of the Amir Ghajar hydro plant. The entire project could be completed by the end of 1963.

In the Ghab area, 41,680 hectares will be irrigated by a system of three main canals, one on each bank of the Orontes, branching from an intake to be constructed near Acharneh, and a third, made from the present bed of the Orontes, originating five kilometers downstream near Ammourine from an intake built in the new Orontes. This will irrigate the lands between the river and the two other main canals. The total area brought under irrigation in the Ghab, taking into account the 13,600 hectares now under partial irrigation, will not exceed 28,000 hectares until about 1963. If temporary limitations on summer irrigation are to be avoided, the work will have to proceed according to a closely coordinated schedule.

*Cost*

The preliminary cost estimate made in 1952 and later brought up to date at the request of the International Bank forms the basis of the following estimate, which includes engineering and supervision expenses, and which assumes that the major proposed technical revisions of the provisional plans will be adopted. On this basis the total cost of the full program is estimated at £S 130.85 million, exclusive of the cost of local and national roads, or £S 169.85 if these are included.[1] The foreign exchange requirement would be about one-third of these totals. During the term of the mission's program (to December 1960) disbursements are likely to be £S 84.25 million without roads or £S 110.25 million if roads are included. Additional funds required for indirect consequences of the project have not been included in the costs for the main project.

[1] All figures are exclusive of any margin for contingencies.

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*Economic Benefits*

The mission estimates that the gross value of the produce of the Ghab area will be in the neighborhood of £S 63 million annually, or about £S 47 million after deducting the amount already produced in the area in question. The production of cotton, maize, sorghum, rice and sugar beets is particularly likely to have a marked impact on Syria's balance of trade. It may be assumed that the output of cotton and cottonseed will in effect be added to the country's exportable surplus; the additional rice production may make Syria fully self-sufficient in that commodity; and the sugar beet production should permit a considerable import saving.

In addition to the project's contribution to an increase in national income and an improvement in the balance of payments, the settlement of farmers in the area made possible by the project will assist in relieving the present population pressure in the province of Latakia and particularly in the Alaouit mountains. In Latakia, for example, the amount of cultivated land available per person is less than 50% of the average for Syria as a whole. Settlers in the Ghab will be able to earn substantially more than the bare living they have been able to eke from the soil in the past.

*Organization*

The "Administrative Office of the Drainage and Irrigation Works of the Ghab Lands" was created in 1951, to be attached to the Ministry of Public Works until the technical work is completed. It will be responsible for the design of the works, award of contracts, supervision of construction, payment of expenses and for sale of the land. As parts of the project are completed, the Office will take care of the operation and maintenance of the dams and of the irrigation and drainage networks and will collect water charges. During the planning and construction period the Office should recruit and train staff to carry out the continuing operation and management of the project.

It is important that the policy, and the attendant operating and budget delegations, provide for the establishment and operation of the agricultural research centers and for a long-range educational and farm demonstration program; otherwise, it will be practically impossible to achieve acceptable land use in the area.

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## II PROJECTED SCHEMES

185 The Youssef Pasha project is the most important of those under consideration, but it is still at the planning stage. No decision has been taken with regard to the irrigation of the Euphrates valley as a whole.

### *Euphrates Valley—Youssef Pasha Dam*[3]

In Syria the long narrow Euphrates valley stretches generally northwest to southeast from Djerablous at the Turkish border to Abou Kemal at the Iraqi border. It is about 450 kilometers long; its average width is about 7.5 kilometers, its maximum 16.

The soils of the valley proper are mainly alluvial, varying from silt to sandy loam and clay. With irrigation, they would be suitable for cotton, rice, sugar beet, peanuts, sorghum, etc. as summer crops, and wheat, barley and winter legumes as the main winter crops.

Irrigation of the whole Euphrates valley, on the assumption that about 85% of the land can be cultivated, would require about 170 cubic meters per second, more than can be assumed to be Syria's share of the natural flow of the Euphrates. Irrigation could probably profitably be extended to an additional area of about 130,000 hectares on the left bank in the vicinity of Raqqa. All in all, a total supply of about 226 cubic meters per second would be needed, about 75% of the maximum of 300 cubic meters per second utilizable for irrigation from the river's natural flow, which would leave only 25% for Iraq. For this reason, and because of the power potential, it was thought desirable to construct a storage dam on the Euphrates; Youssef Pasha was selected as the site. British engineering consultants recommended a concrete dam of the pierced type, 650 meters long with 52 sluice gates, and a power plant capable of producing about 45,000 KW of firm power or a yearly output of about 400 million KWH, plus about 120 million KWH of secondary power.

The consultant firm originally estimated the project cost, including a transmission line to Aleppo, at about £S 114 million; a revaluation made in 1953 raised the estimate to £S 150 million. The capacity of the reservoir behind the dam would increase the flow of the river utilizable for irriga-

[3] Since studies of the valley have not advanced to the point of a draft project, the figures which follow are only indications of the order of magnitude of possible development.

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tion by about 100 cubic meters per second; this, added to Syria's assumed share of the natural flow, would provide sufficient water to irrigate the valley, including the area on the left bank.

Until recently it was thought that the length of head canal needed to connect Youssef Pasha with the irrigable areas would, because of difficult topography, preclude construction of an economic gravity irrigation system. The mission, taking account of experts' reports, has the following comments:

About 48,000 hectares on the river's right bank, between Youssef Pasha and Halabiye gorge, could be irrigated by pumping, at a cost of about £S 50 million; but this would not be an economic method of irrigating the fertile Ressafe plain. Both the valley and about 6,000 hectares of the plain could be irrigated by constructing a gravity canal branching from Youssef Pasha, at a cost of about £S 100 million. Whether it is worthwhile to spend an additional £S 50 million to irrigate a portion of the plain is a question to be considered.

On the left bank, however, a gravity canal branching from the Euphrates at the foot of Youssef Pasha dam could reach the plateau west of Raqqa, 100,000 hectares of which are now without any possibility of being irrigated, and could provide wide-scale irrigation between Ressafe and Halabiye gorge. About 185,000 hectares of excellent soils could be irrigated, about 155,000 by gravity flow and about 30,000 by pumping from the canal.

The possibilities of such a project should be investigated. We have made provision for such a study in our allocation for Euphrates valley studies; the aerial survey and mapping of the area are allowed for elsewhere. The gravity irrigation portion should cost roughly £S 266 million, of which £S 150 million (55%) represents the cost of the head canal. The pumping facilities would cost about £S 34 million. The construction cost of the project would thus be about £S 1,700 per hectare, less than that of the Ghab project.

*Halabiye Project*

Halabiye gorge offers an excellent site for a diversion weir: inundations would be restricted to the gorge itself. The weir could feed two irrigation canals, one on each bank of the Euphrates, extending 250 kilometers to Abou Kemal near the Iraqi border, and these could supply gravity irriga-

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tion to about 165,000 hectares, leaving about 50,000 to be irrigated by pumps.

The cost of such a project would be about £S 165 million, or £S 1,000 per irrigated hectare. But although it would irrigate the fertile Meyadine area and foster development of the Abou Kemal locality, we do not recommend its construction during the next five years. Halabiye is rather far down the Syrian Euphrates valley; much of the area is already under pump irrigation; and for the limited capital expendable the Youssef Pasha site offers wider potentialities, particularly in the generation of hydroelectric power for the Aleppo area.

*Khabour Valley*

The Khabour valley has possibilities for projects in addition to the Tell Maghass scheme. None has been fully investigated. The soils are generally of good quality, ranging from loamy sand to medium clay, suitable for cultivation of cotton, rice, peanuts and (in the northern parts) sugar-beet. All summer crops must be fully irrigated, and although rainfall is more plentiful here than in many parts of Syria, partial irrigation of winter crops is advisable in some areas.

A diversion weir could be constructed across the Khabour downstream from Ras el Ain to feed an irrigation canal on each bank. Areas of 13,300 and 7,400 hectares, on the right and left banks, respectively, could be irrigated. Rainfall in this area is adequate for winter crops and several large estate owners have installed pumps for summer cultivation.

A canal could be excavated on the right bank of the river, from Tell Maghass, but no more than 3,800 hectares would be irrigated; moreover, the soil is not very good, being sometimes excessively salted with gypsum.

About 12 kilometers downstream from Hassetche a dam could be built on the site of the ruined Roman dam of Saba Skour. Although this would permit the irrigation of about 15,000 hectares, it would unfortunately reflood the site of the previous reservoir whose fertile alluvium is now under cultivation.[8]

Sixteen kilometers downstream from Saba Skour another ruined Roman dam formerly supplied two large canals, one on each bank of the Taf river, a tributary of the Khabour. Here could be built an earth-fill dam,

[8] The area of this site is difficult to determine owing to the flatness of the surrounding country.

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about 760 meters long and 15 meters high, to feed a 14-kilometer canal on the right bank, irrigating about 8,000 hectares (a longer canal might irrigate 10,000-15,000 hectares) and a shorter left-bank canal, irrigating about 6,000 hectares. The soil is fairly good, and the mission considers this the best project that could be started in the Khabour area. A rough cost estimate is about £S 30 million, or £S 1,500 to £S 2,000 per hectare, depending on the area irrigated.

All told, these projects would irrigate 62,000-69,000 hectares, including the 8,500 now irrigated by the left bank canal of Tell Maghass. With a duty[4] of 0.6 liters per hectare per second, about 40 cubic meters per second would be needed. Since that is the total discharge of the Khabour utilizable for irrigation, no water would remain for dry season cultivation downstream from the Taf. Accordingly, consideration has been given to storage of the Khabour flood. The downstream portion of the valley is very flat, with the exception of the right bank where it is bordered by an eroded plateau. The plateau is nearest to the river at Markada, and here a dam could be built to form a reservoir. About 800 million cubic meters could be stored behind a dam about 20 meters high; even after loss through evaporation from the large surface area, about 700 million cubic meters would remain, or about 45 cubic meters per second for a six-month irrigation season. This discharge could irrigate about 75,000 hectares out of a possible 250,000 along both banks. The sandy and loamy alluvial soils of this area would be suitable, under irrigation, for the cultivation of rice, cotton, peanuts, pulses, sorghum and maize.

The site's disadvantage is that the gentle slope of the left bank would require construction of a long levee, although there is an easy abutment for the dam on the right bank. Moreover, because the height of the dam would necessarily mean a very shallow reservoir, it would be difficult to prevent siltation. In the circumstances, the government has made no study, survey or cost estimate of the project. The mission recommends that aerial and ground surveys and mapping be undertaken to determine whether the site is satisfactory or whether an alternative must be found. As a first step, the ground survey should be limited to five or six profiles in the area contemplated for the reservoir. This should take about three days, at a cost not in excess of £S 1,000, to be charged to the study of the Euphrates valley, where most of the stored water would be utilized.

[4] The average quantity of irrigation water which must be applied annually to the land to bring the crops to maturity.

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*Upper Orontes Valley*

312 653 185 In the area of Homs two projects are under consideration to expand cultivation in the upper Orontes valley, where cotton and sugar beet can be grown as summer crops and wheat, barley and clover as winter crops: a canal branching from Homs Lake to irrigate about 3,000 hectares on the left bank of the Orontes, and one branching from a diversion weir to be constructed about 23 kilometers upstream of the south end of Homs Lake. Here the dry season flow of the Orontes is at least 10 cubic meters per second, sufficient to irrigate about 15,000 hectares on the right bank, so that the Ghab project would not be adversely affected. However, the Orontes rises in Lebanon, where a project to irrigate the Kaa area is being considered. This would reduce the available flow at the Syrian border, correspondingly reducing the irrigable area in Syria. Since the project is estimated to cost about £S 15 million, an agreement with Lebanon on the partition of the Orontes should be concluded first. We also recommend a more accurate geological survey of the Rastane reservoir area, to ascertain whether potential capacity has been overestimated. Meantime, the two projects should be deferred.

*Barada Valley*

Consideration has been given to regulating the flow of the Barada river, to increase the irrigated area of the Ghouta in the vicinity of Damascus where soils toward the valley bottoms are suitable for the growing of vegetables.

Two dams across the Barada river at Hameh and near Makaren, each about 50 meters high, would provide a total storage capacity of about 180 million cubic meters, thus increasing the utilizable irrigation flow from 7 to about 15 cubic meters per second and permitting dry season irrigation of about 15,000 hectares of new fertile land in the vicinity of Damascus. A hydroelectric power plant could be built at the foot of each dam to develop a total power of about 10,000 KW.[8]

Surveys and studies have not progressed to the point of a draft project. A rough cost estimate is about £S 10 million for each dam, plus not more than £S 10 million for the development of the canal system, making a total

[8] These are recommended in Annex G.

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of about £S 30 million for the project (exclusive of the hydroelectric plants), or about £S 2,000 per hectare. The mission recommends that studies of the two sites be completed and that construction of the dams and hydro plants begin as soon as possible.

*Yarmuk Valley*

Cultivation on the alluvial and sometimes very fertile soils[a] of the Mzerib area irrigated from the upper springs of the Yarmuk river could be extended by pumping water to a new area of 4,500 hectares. This second phase of the Mzerib irrigation project has been fully investigated and is ready to be started; the first phase is already in operation. The pumps would be driven by diesel motors unless and until it is decided to build a hydroelectric power plant on the Yarmuk. The cost is estimated at about £S 7 million, approximately £S 1,500 per hectare. In view of the interest in developing irrigation in the Hauran mohafazat, which is in general not well provided with water, the mission recommends that this project be started without delay.

*Nahr el Kebir Valley*

The Nahr el Kebir, a short river flowing from the mountains bordering on Turkey, empties into the Mediterranean in the vicinity of Latakia. It has heavy floods, but in dry season the flow is no more than 0.5 to 0.6 cubic meters per second. A regulated flow would permit irrigation of about 4,000 hectares in the vicinity of Latakia for vegetable growing, thus making a significant contribution to the general development expected with the improvement of the port.

The construction of a dam of about 60 meters is projected, with sufficient capacity to permit flood control, irrigation, power and water for the port of Latakia. Site surveys are already under way. Additional cost studies must be made, but the cost will probably be of the order of £S 15 million. Although this is rather expensive for a single project, the mission feels that in view of its multi-purpose nature and the great importance of the development of the port of Latakia, studies should promptly be completed and the project constructed during the next five years.

[a] Suitable for cotton, with peanuts and citrus on the lighter soils.

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### *The Mission's Program*

The new irrigation projects recommended by the mission, together with those under way, call for a total expenditure of £S 193 million over the next five years, to which must be added £S 3 million for maintenance and £S 1.2 million for research and demonstration, giving a grand total of £S 197.2 million. Table 1 shows the allocations among projects, together with an indication of the areas to be irrigated. Appendix Table II sets forth the irrigation schemes.

TABLE 1 Mission's Proposed Irrigation Program, 1955–60

| Irrigated area | | | | | | | |
|---|---|---|---|---|---|---|---|
| New area | Already irrigated | Total | Projects | Functions | Total | Already spent | To be spent in the program |
| 43.0 | 22.0 | 65.0 | El Ghab | D + GI | 103[a] | 1 | 102 |
| 0 | 0 | 0 | Euphrates valley studies | | 3 | — | 3 |
| 4.5 | 4.0 | 8.5 | Tell Maghass (LB) | GI | 12 | 10 | 2 |
| 4.0 | 0.5 | 4.5 | Roudj | D + GI | 5 | 2 | 3 |
| 4.5 | 0.5 | 5.0 | El Senn | GI + PI | 3 | 2 | 1 |
| 4.6 | 0 | 4.6 | Mzerib | PI | 7 | 0 | 7 |
| 10.0 | 10.0 | 20.0 | El Taf | GI | 30 | 0 | 30 |
| 15.0 | 0 | 15.0 | Banda | HEP + GI | 30 | 0 | 30 |
| 3.5 | 0.5 | 4.0 | Nahr el Kebir | HEP + GI | 15 | 0 | 15 |
| 89.1 | 37.5 | 126.6 | | | 208 | 15 | 193 |

*Key:* GI – Gravity Irrigation; HEP – Hydroelectric Power; LB – Left Bank; PI – Pumping Irrigation; FC – Flood Control; D – Drainage; R – Regulation

[a] Including £8.47 million to be spent in a later program.

NOTE: Area figures in thousand hectares; expenditure figure in million £S.

## III PLANNING

There are two stages of planning for irrigation projects. The first, the agricultural phase, entails a preliminary study of the soils and the computation of water duties. The technical phase includes planning of the civil engineering works necessary to divert, convey and distribute the water in the selected area. In the Main Report the mission has discussed the second

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planning stage. Here we add a comment with respect to the so-called agricultural phase.

In the past, soil studies were not very extensive, but projects were being constructed in areas already under cultivation, where the fertility of the soil was well known. Now FAO experts supervise systematic soil analyses, and the results of these studies will be very useful for the development of future projects. Insufficient investigation of the perviousness of the soil, with consequent underestimation of the water duty, has resulted in undercropping in some irrigated areas. A striking example is the Homs Lake project, where the allowance of 0.20 liters per hectare per second does not permit full utilization of the cultivable area.

The mission therefore recommends that henceforth more extensive research under the supervision of both irrigation and agricultural engineers precede fixing of the irrigation duty. Since the soils vary little along the alluvial plain of the Euphrates valley, these studies could be confined to plots in Raqqa, Deir ez Zor and Abou Kemal, on the plateau west of Raqqa and in the Resafe plain south of Abou Hareira. These experimental plots could be quite small, water being supplied by small pumping plants or even by tankers. Provision is made in the mission's proposed expenditure on studies of Euphrates valley irrigation for equipment of experimental stations.

## IV WATER FEES

The fees for the various projects, according to the revised schedule for 1954, are shown in Table 2.

TABLE 2 Annual Water Fees per Hectare

(£S)

| Project | Size of holdings in hectares | | | | |
|---|---|---|---|---|---|
| | 0 to 5 | 5 to 15 | 15 to 20 | 20 to 50 | over 50 |
| Homs-Hama | 6.25 | 15.40 | 20.40 | 23.30 | 25.80 |
| Tell Maghass | 7.50 | 23.75 | 28.75 | 37.50 | 40.00 |
| Maarib | 7.50 | 21.25 | 26.25 | 32.50 | 35.00 |
| Sena | 7.50 | 17.50 | 22.50 | 27.50 | 30.00 |
| Makt | 2.00 | 3.50 | 4.50 | 6.00 | 7.00 |

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312 427 In the mission's opinion the amortization period of 65-70 years is too long; if the same standards were applied to the new projects requiring large investment Syria's economic development would be hindered. We recommend a further revision of the basis for calculating the fees so that capital cost is amortized in a period of, say, 35-40 years, provided that in no case should the fee exceed the money value of the benefits to the landowner or cultivator. Benefits should be conservatively calculated to allow for variations in prices and yields of crops.

It also appears that although small holders might appropriately be charged a lower rate, the degree of progression in the existing water fees may be excessive.

APPENDIX

311 312 TABLE I River Flow and Government's Estimate of Irrigated and Irrigable Areas

| Origin of utilized water | Annual flow (million cubic meters) | Irrigated area (thousand hectares) | Irrigable area (thousand hectares) |
|---|---|---|---|
| Euphrates | 25,000 | 125.0 | 340.0 |
| Khabour | 1,500 | 20.0 | 90.0 |
| Orontes | 500 | 35.0 | 55.0 |
| Yarmuk | 450 | 3.0 | 7.5 |
| Barada-Awadj | 485 | 15.0 | 25.0 |
| Kowek | 75 | 12.0 | 15.0 |
| Afrin | 250 | 2.5 | 7.5 |
| Sadjour | 90 | 2.5 | 3.0 |
| Baligh | 150 | 8.5 | 10.0 |
| Jagh-Jagh | 90 | 8.0 | 10.0 |
| Senn | 360 | 0.5 | 5.0 |
| Nahr el Kebir | 150 | 0.5 | 2.0 |
| Total | 29,100[a] | 232.5 | 570.0 |
| Underground water | | 75.0 | 100.0 |
| Miscellaneous | | 67.5 | 80.0 |
| Gross total | | 375.0[b] | 750.0[b] |

[a] To which should be added approximately 500 million cubic meters from other small rivers and streams.

[b] Underestimated, in the mission's opinion.

SOURCE: Directorate of Irrigation.

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The low fee for the Makt project is justified by the restricted natu[illegible] the facilities provided, but the fees assessed for the Tell Maghass, M[illegible] and Senn projects appear low in proportion to the money value of the benefits to the landowners or cultivators, and are considerably less than the cost of pumping irrigation provided by private owners. Accordingly, we have recommended review of these fees.

APPENDIX

TABLE II Irrigation Schemes Under Construction or Projected

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| Irrigated area (thousand hectares) | | | Location | Functions | Expenditures (million £S) | | |
|---|---|---|---|---|---|---|---|
| New area | Already irrigated | Total | | | Already spent | To be spent | Total |
| 43.0 | 22.0 | 65.0 | El Ghab | D + GI | 1 | 170 | 171[a] |
| 252.0 | 152.0 | 404.0 | Youssef Pasha | | — | 150 | 150 |
| 140.0 | 45.0 | 185.0 | Raqqa Plateau | GI + PI | — | 300 | 300 |
| 85.0 | 80.0 | 165.0 | Halabiye | GI | — | 160 | 160 |
| 27.0 | 27.0 | 54.0 | Resafe | GI or PI | — | 100 | 100 |
| 4.0 | 0.5 | 4.5 | Roudj | D + GI | 2 | 3 | 5 |
| 4.6 | 2.2 | 6.8 | Mzerib | GI + PI | 2 | 7 | 9 |
| 15.6 | 5.1 | 20.7 | Ras el Ain | GI | — | 30 | 30 |
| 4.5 | 4.0 | 8.5 | Tell Maghass (LB) | GI | 10 | 2 | 12 |
| 2.8 | 1.0 | 3.8 | Tell Maghass (RB) | GI | — | 6 | 6 |
| 8.0 | 7.2 | 15.2 | Sabe Skour | GI | — | 25 | 25 |
| 10.0 | 10.0 | 20.0 | El Taf | GI | — | 30 | 30 |
| 53.0 | 22.0 | 75.0 | Markada | GI | — | 100 | 100 |
| 8.0 | 7.0 | 15.0 | Upstream Homs Lake | GI | — | 15 | 15 |
| 3.0 | — | 3.0 | Homs Lake (LB) | GI | — | 3 | 3 |
| 4.5 | 0.5 | 5.0 | El Senn | GI + PI | 2 | 2 | 4 |
| 3.5 | 0.5 | 4.0 | Nahr el Kebir | HEP + GI | — | 15 | 15 |
| 15.0 | — | 15.0 | Barada | HEP + GI | — | 30 | 30 |
| 431.5 | 235.0 | 665.5 | | | 17 | 1,148 | 1,165 |

*Key:* GI – Gravity Irrigation; HEP – Hydroelectric Power; RB – Right Bank; PI – Pumping Irrigation; FC – Flood Control; LB – Left Bank; D – Drainage; R – Regulation

[a] Including local and national roads.

NOTE: The figures given above are only rough estimates. Accurate figures are not available because most of these irrigation schemes have not yet reached the draft stage. The purpose of this Table is to give an idea of the order of magnitude of the investment, extending beyond the scope of the mission's program, to be made for the development of irrigation in Syria.

14:International Bank S-5 (1954) 1955 MD1 Syria MD1



*Raw Materials*

Considering the present structure of Syrian industry, its supply of raw materials is generally speaking not unsatisfactory. In the preceding section we have referred to the import needs, if any, of Syria's principal industries. Most local and imported raw materials are generally available at competitive prices. The principal exception is sugar, the high price of which presents a serious drawback to the fruit canning, jam and candy industries. The prohibition of imports of cotton seed for industrial use hampers the ability of vegetable oil manufacturers to enter the export market at competitive prices. Some branches of the textile industry dependent on imported cotton yarn or cloth, subject to high customs duties, are in a similarly unfortunate position.

On the other hand certain laws or regulations in effect give some Syrian industries a right of first refusal with regard to locally produced raw materials; export of both ginned and non-ginned cotton, cotton seed, raw wool and raw hides, is subject to licensing, while export of timber and raw metals is prohibited. The efficacy and desirability of such measures may be questioned (see Section IV), but they are elements of the prevailing industrial climate.

The transportation of local raw materials to the industrial centers, where they are processed, is not unduly burdensome, thanks to the favorable location of Syrian industries in or near the producing areas. Moreover, the distances between these centers and the seaports are not too great. Nevertheless, transportation in Syria is relatively costly and an improvement in the transport sector would not only facilitate exports of surplus raw materials but would also benefit the processing industries and their competitive position.

*Water and Power*

The main industrial centers are, generally speaking, well provisioned with water. Damascus has the best water supply among Syrian cities, thanks to the springs of Figeh. Aleppo's water supply, which was so inadequate that some factories had to select sites outside of the town where they could drill their own wells, has now been greatly improved by a link with the Euphrates River. Homs and Hama have more than sufficient water

14:International Bank S-5 (1954)1955 MD1 Syria MD1



resources in Homs Lake. The water rates charged by the municipalities are by no means excessive.

With regard to electricity for light and power the conditions are, however, much less favorable. The capacity of the municipal power plants in the four main industrial cities is far from sufficient to meet total consumption needs. Most of the larger factories have had to install their own power plants, which imposes an additional capital burden on them.[3] Factories which have no power plant of their own often suffer considerable losses resulting from breaks in the power and light supply. Electricity rates of public utilities, although higher in Syria than, for instance, in Lebanon, Turkey and Egypt, compare not unfavorably with those in the main Western industrial centers.

*Equipment*

The mechanical equipment of the major industries is in general good. Obsolete or inefficient machinery is continuously being replaced by new plant. Nevertheless, there are still many old factories and workshops where equipment is primitive and modernization is much needed.

Some industries, however, seem as a whole to be overequipped in relation to the available raw material supply or the market outlets for their products. A striking example is the installed capacity in the cotton ginning industry, which could handle between two and three times the present cotton crop. This is no doubt due in part to an overestimation at the time of the cotton boom. The government has accordingly prohibited the importation of cotton gins. In the case of the vegetable oil industry the installed capacity might be more fully utilized if cotton seed were freely importable and oil manufacturers could enter the export market for vegetable oils at competitive prices. As a complement to the protection of local cotton seed, the government has also placed an embargo on the importation of vegetable oils. A third instance of overequipment is in the glass industry: the Damascus factory was designed and installed on the basis of the rather ambitious notion that it should serve most of the needs of the Middle East. Some of its machinery, as for instance that for the manufacture of electric bulbs, has never been in operation. Although most of the items it produces may not be imported into Syria and although recently

[3] See Annex G, p. 413.

MISCELLANEOUS

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## AREA OF LAND CULTIVATED AND UNCULTIVATED, BY MOHAFAZAT, 1952 AND 1953
(Area in hectare)

Table No: 2

| MOHAFAZAT | المجموع العام Grand total | اراضي قابلة للزراعة Cultivable lands | | | غير مستثمرة Uncultivated |
|---|---|---|---|---|---|
| | | Cultivated | | مستثمرة | |
| | | المجموع Total | سقي Irrigated | بعل Non-irrigated | |
| **YEAR 1952** | | | | | |
| Damascus | 1,962,783 | 159,170 | 81,116 | 78,054 | 354,450 |
| Homs | 4,195,000 | 299,280 | 25,280 | 274,000 | 460,000 |
| Hama | 732,185 | 503,965 | 17,114 | 486,751 | 16,500 |
| Latakia | 608,000 | 257,946 | 30,579 | 227,367 | 72,272 |
| Aleppo | 2,112,870 | 1,122,823 | 80,407 | 1,042,416 | 489,792 |
| Al-Hasakeh | 2,217,000 | 540,452 | 44,694 | 495,708 | 596,820 |
| Deir-ez-Zor | 5,306,000 | 261,683 | 200,840 | 60,843 | 1,082,791 |
| Suweida | 555,000 | 60,590 | 100 | 60,590 | 60,590 |
| Dir'a | 427,632 | 279,432 | 11,932 | 267,500 | 4,200 |
| Total | 18,276,470 | 3,485,251 | 492,062 | 2,993,189 | 3,139,545 |
| **YEAR 1953** | | | | | |
| Damascus | 1,962,783 | 159,170 | 81,116 | 78,054 | 354,450 |
| Homs | 4,219,000(1) | 342,430 | 38,400 | 304,030 | 458,900 |
| Hama | 832,138(2) | 539,975 | 28,504 | 511,471 | 22,790 |
| Latakia | 454,000(3) | 178,264 | 9,732 | 168,531 | 57,095 |
| Aleppo | 2,112,870 | 1,236,675 | 89,263 | 1,147,412 | 416,736 |
| Al-Hasakeh | 2,217,000 | 541,469 | 40,000 | 501,469 | 694,531 |
| Deir-ez-Zor | 5,306,000 | 326,713 | 205,840 | 120,873 | 1,017,761 |
| Suweida | 555,000 | 60,590 | 200 | 60,390 | 60,590 |
| Dir'a | 427,632 | 283,794 | 18,961 | 267,882 | 4,300 |
| Total | 18,276,470 | 3,669,180 | 508,958 | 3,160,222 | 3,087,183 |

Source : Ministry of Agriculture.

(1) Including Talkalakh Qada.
(2) Including Misiaf Qada.
(3) Excluding the Qadas of Talkalakh and Misiaf.

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توزيع المساحة المروية حسب المحافظات ، ١٩٥٣

DISTRIBUTION OF IRRIGATED AREA, BY MOHAFAZAT, IN 1953

Table No. 8

جدول رقم ٨

| MOHAFAZAT | المساحة المروية ( بالهكتار ) : Irrigated Area (in hectares) | | | | | | المحافظات |
|---|---|---|---|---|---|---|---|
| | المجموع Total | مياه الانهار By rivers | مياه الاقنية والينابيع By canals and springs | مياه الآبار By underground water | | مياه السيول By torrents | |
| | | | | بالمحركات by pumps | بالقرانات by norias | | |
| Total | 866,868 | 287,223 | 57,267 | 222,286 | 19,044 | 1,738 | المجموع |
| Damascus | 81,118 | 56,665 | 17,508 | 5,974 | 544 | 430 | دمشق |
| Homs | 38,400 | 26,902 | 6,808 | 4,740 | 50 | -- | حمص |
| Hama | 28,504 | 14,400 | 5,622 | 8,382 | — | — | حماه |
| Latakia | 9,723 | 2,962 | 3,649 | 3,122 | — | — | اللاذقية |
| Aleppo | 89,263 | 59,628 | 12,300 | 11,075 | 4,960 | 1,300 | حلب |
| Deir-es-Zor | 40,000 | 22,825 | 7,025 | 20 | 100 | -- | الحسكة |
| Al-Hasakah | 265,940 | 3,000 | 300 | 189,150 | 13,290 | — | دير الزور |
| Suwida | 300 | 11 | 190 | 1 | — | 8 | السويداء |
| Dir'a | 15,902 | 11,500 | 4,360 | 22 | — | — | درعا |

Source : Ministry of Agriculture

المصدر : وزارة الزراعة

3:Royal Institute of International Affairs U-4 (no date)1954 M1 Middle East
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*Chapter Ten*

# *SYRIA AND LEBANON*

## The Land and the People

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The area of the present Syria and Lebanon lies to the north of Arabia Deserta and is the western horn of the Fertile Crescent. The two republics do not enclose within their boundaries a natural geographic entity and their climate and topography are best studied in relation to the surrounding countries;[1] but within the political boundaries of the two states, the following geographical divisions may roughly be distinguished:

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(1) *The Coastal Strip.* This is about twenty miles wide near Latakia and rather less just north of Tripoli, but in some places disappears and the mountains meet the sea. Olives, bananas, citrus, and vegetables are cultivated intensively near Beirut.

(2) *The Mountains.* Starting from the north, the first coastal mountains are the Jebel Ansariya (also known as the Alawi Mountains) which average 4,000 feet and are well populated on the western slopes. To the south is the Homs–Tripoli gap and then starts the Lebanon range with peaks of over 10,000 feet. Even on the upper slopes of this range water is plentiful, there is close cultivation, and the villages and towns are prosperous. Near Beirut are situated the mountain resorts to which most of the city workers move each night when the summer brings its humid heat. The interior ranges of mountains lying parallel to that of the Lebanon are the Anti-Lebanon (between Homs and Zahle) reaching over 7,000 feet and the range of Hermon (between Zahle and the Israel border) which reaches 9,200 feet. Water and cultivation are far less plentiful on these than on the coastal mountains. Farther inland still and to the south of Damascus lie the Leja, a bleak area of igneous rock, and the Jebel Druze, which reaches 5,000–6,000 feet and lies north of the Jordan border.

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(3) *Plains and Plateaux.* Hardly any of the territory of Syria and Lebanon lies less than 700 feet above sea-level and south of Hama almost all the land is over 1,600 feet. The richest agricultural land is on fairly high ground and forms part of a

[1] See W. B. Fisher, *The Middle East; a Physical, Social, and Regional Geography* (London, Methuen, 1950).

3a Royal Institute of International Affairs U-4 (no date) 1954 MI Middle East
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MAIN CROPS

| | Area (000 hectares) | | Production (000 metric tons) | | Yields (100 kg. per ha.) |
|---|---|---|---|---|---|
| | 1951 | 1952 | 1951 | 1952 | 1950 |
| Wheat | 61 | 70 | 43 | 50 | 7·5 |
| Barley | 15 | 20 | 14 | 27 | 11·2 |
| Cotton | 5 | 2 | 1 | .. | .. |
| Tobacco | .. | .. | 3 | 2 | .. |
| Citrus fruit | .. | .. | 75 | 90 | .. |
| Grapes | 21 | .. | 80 | .. | .. |

.. = not available.

(Sources: Banque de Syrie et du Liban, *Exercice 1952* (Paris 1953); except figures for yields, cotton production, and area and production of grapes, all of which have been taken from FAO, *Yearbook of Food and Agricultural Statistics*, 1952.)

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There is enough water for land to be used more intensively than in Syria but there is not enough room to grow all that the country needs. Improved methods have increased the yield of cereals per acre, but Lebanon will always have to import wheat. The crop of grapes is nearly double the weight of the wheat harvest and Lebanon exports grapes, wine, and the best quality araq. The citrus exports are high but the growers have not yet established the same name for quality as have the Israelis. Melons, water-melons, apples, onions, and potatoes are also important crops and vegetables are exported as far as the oil towns of Kuwait and Dahran. Cotton and tobacco are also grown in small quantities.

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The land is more evenly parcelled out amongst the people in Lebanon than in Syria but, despite the fact that there are many small holdings, there is a general shift from country to town, and Beirut and its immediate neighbourhood hold nearly half of the population. In the coastal regions of intensive cultivation small holdings predominate, while in the plain regions large estates worked by share-croppers are the most prevalent form of land tenure. Some estates owned by rich men are farmed under modern methods and equipment and there is less room for improvement or for expansion in agriculture than in Syria.

*Industry*

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Relative to its size, Lebanon is one of the most industrialized countries in the Middle East area. It is probable that nearly 50,000 persons are so employed, of whom over half are factory workers. However, Lebanese industry has only partly recovered from the loss of the Syrian market and some industries had either to move to Syria or to curtail production. The biggest industries are electricity, which produced 130 million kwh. in 1951, and the Chekka cement factory south of Tripoli, which produced 903,000 tons of cement in 1951. Cotton weaving and

3@royal Institute of International Affairs U-4 (no date)1964 M1 Middle East
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1950–1 amounted to £L215·5 million. Over half this deficit was met from 'invisible' earnings, such as the tourist trade and transportation, and the rest from private donations and capital movements. Indeed, during this period Lebanon's balance of payments showed a small surplus of £L2·7 million.[1] Most of Lebanon's trade (about 40 per cent) is with other Middle Eastern countries, but the foremost country in her trade is the United States (about 20 per cent). Europe and Great Britain are important sources of imports but not such large export markets. Lebanon's main imports are agricultural products, textiles, machinery, and oil, and her chief exports are agricultural products and textiles. The tourist industry is given full encouragement by the Government and, under certain circumstances, tourists' fares to Lebanon are subsidized.

*Development*

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On 24 February 1951 Lebanon signed a Point Four agreement with the United States and the work to be carried out is based on the report to the United Nations in 1949 by Mr Gordon Clapp.[2] Irrigation projects are under way at Akkar, Yamouna, and Qasmiya, and there is a proposal to use the Litani river to irrigate over 12,000 acres of land. In August 1953 the Lebanese Government announced a four-year development plan; the main projects under consideration concern road and hydro-electric power development.

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## Conclusion

The future of Syria and Lebanon will obviously depend to some extent on the past, many aspects of which have not been fully discussed here because the independent political and economic development of the countries began only in 1946. In internal politics events have moved too rapidly for any record to keep pace with them, and there is not yet apparent any stability that would allow one to regard views and information on the political scene as being valid for more than a brief period. As regards their external policy, the two countries have yet to be convinced that there is a community of interest between them and the West. The Western Powers need the use of Syrian and Lebanese territory on which to base a line of defence, but it is not expected that these countries could or should bear a significant part of the burden of defence in men, materials, and money. The Levant wants greater security against Israel than

[1] See table 6, p. 505 below.

[2] UN, Conciliation Commission for Palestine (chairman: Gordon Clapp), *Economic Survey Mission for the Middle East* (New York, December 1949).

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## Chapter VI

# SYRIA AND LEBANON

### LAND AND POPULATION

At first sight, the main crop of Syria appears to be thistles, and so it is in fact: about half the land is under fallow every year, and the cultivated land is cropped only one year in two or even three. There are some districts with intensive cultivation, for instance, the oasis of Damascus, with its brilliant green crops irrigated by 'Abana and Pharphar'; but most of Syria is cultivated very extensively indeed.

In Syria and Lebanon together the area cultivated before the late war was some 5·8 million acres, but of this total only 3,900,000 acres were cropped each year, the remainder being fallow. The greater part of the cropped area was under cereals, about two-thirds being under wheat and one-third under barley.

In Lebanon, the whole of the cultivated area is cropped, and there is no uncultivated land which could be brought into cultivation. In Syria however there are large areas of cultivable land which are not at present cultivated, the total cultivable area being some 12½ million acres, of which only about one-third is under cultivation. Unfortunately this figure is only a rough estimate, and it is not clear how much of the area is cultivable under present conditions, or how much of it is marginal desert grazing. Some of it is undoubtedly cultivable under present conditions, and there is certainly no shortage of land in Syria.

SYRIA: AGRICULTURAL LAND, 1943[1]

| *Province* | *Cultivable* | *Cultivated (including fallow)* |
|---|---|---|
| | *Acres* | *Acres* |
| Jezira .. .. .. | 2,471,000 | 543,600 |
| Euphrates .. .. .. | 3,212,000 | 321,200 |
| Aleppo .. .. .. | 3,706,000 | 1,260,000 |
| Homs .. .. .. | 420,000 | 345,900 |
| Hama .. .. .. .. | 1,909,000 | 1,210,000 |
| Damascus .. .. .. | 1,062,000 | 345,900 |
| Hauran .. .. .. | 518,600 | 518,900 |
| TOTAL .. .. .. | 12,698,600 | 4,545,500 |

[1] Omitting the provinces of Latakia and Jebel ed Druz for which no figures are available; their cultivated area may be estimated at about half a million acres.

25: Warriner S-5 no date 1948 MI Middle East
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Syria MD1



probably few, of the estates are the properties of old, wealthy families of Ottoman times, which still exist in Lebanon, such as the lands belonging to the families of Arslan, Jumblatt, Chehab, Khazen, but many of these have been broken up by the Moslem laws of inheritance. Other estates have originated from direct grants made by Turkish Sultans to influential politicians, as for example the two very large estates in the Beqa and the Litani valley. Others too were formed at the time of the general registration of property undertaken by the Ottoman Government when chiefs of tribes or villages registered tribal land in their names as their private property. Uncertainty about legal title to land gives the educated classes frequent opportunity for ousting peasant owners, and whole villages have come into the possession of rival groups of city notables, as a result of litigation among the villagers who have sought their assistance in establishing their title.

While the land-tenure system is thus a result of peasant poverty, it also perpetuates poverty by standing in the way of any long-term investment. The high percentage of fallow in Syria suggests a great waste of land resources, and there could certainly be some improvement in yields, even in dry land farming, if green crops were introduced more generally into the rotation. But the share-cropper has little incentive to improve the fertility of the land, since he has no certainty of tenure, and since the landlord will take 50 per cent of any increase. Since the landlords are not as a rule directly interested in farming, they do not themselves undertake long-term improvements in the land.

Three case studies illustrate the ways in which the land-tenure system hinders advance.[1]

One study relates to the large estate of Misherfe, near Homs in central Syria. This is 24,000 acres in extent and includes five villages, with 2,500 inhabitants. It is very extensively cultivated, only one-third of the area, 8,000 acres, being cropped each year. The land is divided into three parts, one with wheat, barley or *qatani* (mixed grain), one ploughed but not sown, and one left fallow. A small area, 200 acres only, is irrigated, though water supplies are sufficient to irrigate much larger areas.

[1] These studies, which were prepared for the M.E.S.C., are not at present available in print.

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their animals. Malaria is prevalent. The majority are heavily indebted. The tenants on the irrigated land, with an average holding of 18 acres, are also poor but less heavily indebted, because they can depend on a more regular income.

The poorest class are the landless labourers whose income in money and kind amounts to 530 Syrian pounds a year (1944) (£10 at 1939 prices).[1] This is a starvation wage, which means that they can only eat enough in harvest time, and in winter must subsist on maize, bread, and grass.

The poverty on this estate is therefore a result of the low productivity and the low proportion of the area under cultivation. One way of increasing the area cultivated would be by the use of machinery. Tractors were introduced some fifteen years ago, but proved too costly in relation to the low prices of Syrian grain; owing to lack of skilled drivers and proper maintenance they fell into disrepair. During the late war, however, as the price of grain rose, tractors were again used by some tenants who hired them from neighbouring estates.

Another way of raising production would be to increase irrigation since there is sufficient water to supply much more land. In this respect the estate is typical of the whole Homs–Hama plain, where much of the water which the French authorities have made available by irrigation goes to waste.

On this estate, therefore, the poverty of the cultivators is due to the landowner's failure to increase the productivity of the soil, rather than to his exploitation of the peasants; compared with other estates, this one is socially progressive, since the landowner's family have set up a school and also distribute medicines free of charge.

The second study covers a more intensively cultivated village, Ashrafie on the borders of the irrigated district of Damascus. Less heavily supplied with water than El Ghuta itself, Ashrafie has sufficient water to irrigate 10 per cent of the total land. The total area is 1:600 hectares or 4,000 acres, of which 2,400 are owned by four estate owners and the rest by peasants. The largest landowner is an absentee, letting his land on a 50 per cent share-tenancy basis, with definite three-year leases (by contrast with the usual custom under which the tenant has no lease).

[1] This is calculated on a rate of 9 Syrian pounds to £1, allowing for a six-fold increase in the Syrian cost of living between 1939 and 1944.



1 [The estate of Misherfe, near Homs -- Analysis]

into single units, to form individual farms; but shortage of money limited this process to about 50,000 acres.

About half the area of Syria has been surveyed and title registered by the Bureau de Cadastre. As in Palestine, political unrest made it impossible to survey and register some districts, in particular the Hauran and the Jezira. With this limitation the work of the department appears to have been successful.

*Water-Rights.* One of the great obstacles to carrying out large-scale irrigation schemes is the confusion which prevails about water-rights. According to an unpublished report prepared for M.E.S.C. in 1943 by Professor Addison, one important scheme, the Yamunne project, could not be initiated, because the complicated question of water-rights had not been settled. Since any big advance in agriculture really depends on irrigation, a settlement of water-rights is essential.

The French authorities have apparently been no more successful in dealing with this question than the British authorities in Palestine and Transjordan. A decree was issued by the High Commissioner in June 1925 nationalizing the water supply, and making all sources of water and water-courses public property; but a further decree in 1926 weakened this wise measure, permitting temporary occupation of water-rights for forty years, so that the result of the legislation has been to increase the confusion.

*Control of Irrigation.* There is no uniformity of procedure in controlling irrigation schemes, and no central authority controlling irrigation. There are three chief methods of control quite unrelated to each other. These are:

1. The village community in which water-rights are regulated by custom. This appears to be the prevalent method of control in all the village irrigation schemes, of which there are a very large number. Several villages may share in these schemes, and the distribution of water is established between them by custom, and administered by the village authorities. Each owner of land can claim a share in the total water supply measured as a unit of time, for example, one hour every seven days. This method is beginning to prove unsatisfactory. The big owners almost always control the best

25: Warriner S-5 (no date) 1948 MI Middle East
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Syria MDI



irrigated land, and village chiefs can frequently be bribed to leave open irrigation ditches so that their land is better watered. This frequently happens, for example, in the Ghuta of Damascus, where there is no unified plan for the irrigation of the district and no authority which can enforce the customary rights.

2. The system under which water is owned collectively, or as *Waqf*, in the northern Beqa.

3. Private ownership by large landowners. This is usual in the Lebanon where there are a number of small private schemes.

These methods of control apply to the smaller schemes. Large-scale schemes have been operated either by:

1. Private concession. Only one relatively large-scale concession is actually in operation, the Nahr Ibrahim (Adonis) scheme.
2. The State. State-controlled works have been carried out by
   (i) authorities directly under the control of the French authorities;
   (ii) authorities directly under the control of the Lebanese Public Works Ministry;
   (iii) Lebanese or Syrian authorities under the control of the Délégation Générale.

There is great need of a central authority to co-ordinate the supply of water. In the south Beqa, for instance, much irrigable land is left unirrigated and much water allowed to run to waste for lack of such an authority.

*State Land.* One of the main reasons for the lack of intensive cultivation in central Syria is that the State lands have never been systematically settled. Very large areas are State domain, that is, land registered as the property of the Turkish Sultan, Abdul Hamid. Under the mandate, this land became the property of the local government. Under the Turks these lands were used for the 'displaced persons' of the old Empire, who were driven out when Turkish territory was lost, but they were still sparsely settled when the French took over.

After the rising of 1925 the French authorities began to settle

25: Wanner S-5 (no date) 1948 MI Middle East
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better cultivation, if more machinery were available, to reduce the fallow to one year out of two, instead of two out of three in the districts where this is customary; it would also be possible, by machine cultivation, to keep weeds under control. (See Chapter VIII.)

The main possibilities of development, however, depend on irrigation. At present an area of some 500,000 acres is irrigated, and even under the existing scheme much water is wasted. How much additional land could be irrigated is a subject for controversy. Mr Soubhi Mazloum, a Syrian irrigation engineer, suggests that the total area which could be irrigated, including the use of the Euphrates water, may be as large as 1,200,000 hectares (2,960,000 acres):[1] but this figure refers to the area which it is *physically* possible to irrigate, not the area which could be irrigated with any prospect of economic return.

A more exact and detailed estimate was prepared by Professor Addison, the irrigation expert, who surveyed existing schemes in 1943 and considered that the extension of these which was then economically practicable would irrigate some 68,000 hectares (168,000 acres) in addition to the area already irrigated. The difference between these two estimates indicates how wide a range of opinion there is. A survey is now being prepared by a British irrigation firm on behalf of the Syrian Government, to provide the basis of development projects, and pending its publication it is impossible to quote any more satisfactory estimates.

*The Jezira and Euphrates Provinces.* In inner Syria, the Jezira area and part of the Euphrates province in the north-eastern corner of the country, there are quite large possibilities of extending cultivation both in the rain-fed zone, and by irrigation. North of a line from Tiyne to Sheikh Saleh there is sufficient rainfall to water the winter crops. In the 'Duck's Bill' and along the Turkish frontier to a depth of about 12 miles to Derbisiye, the rainfall is 50 to 100 centimetres per year (20–40 inches), and south of this there is another belt with rainfall of 25 to 50 centimetres (10–20 inches), about 50 miles wide.[2]

[1] 'Le Problème de l'Eau au Liban et en Syrie', in *L'Agriculture, Richesse Nationale*, (Beirut, 1942).

[2] This information is based on an unpublished report prepared for M.E.S.C. in 1944.

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Syria MD1



Within this belt there is a large area of cultivable land still uncultivated, mainly for reasons of shortage of labour, lack of means of communication, and political insecurity. Uncultivated land is generally used for grazing, and in the 'Duck's Bill' the grass grows high enough for hay cutting. At present the cultivated area is some 481,500 hectares (1,188,000 acres), and it is estimated that an area about as large again remains uncultivated.

The population at present numbers 111,900, of which half are Kurds. Owing to its remoteness and unsettled state, there has been no survey and settlement of land title. New land is taken under cultivation under the old Ottoman right by which ownership is acquired if cultivation can be proved for ten consecutive years.

In the Jezira most of the land is held by large cultivators. In the Euphrates province much of the land has until recently been owned by the villagers, but now the land is passing into the hands of city landowners as pump irrigation is introduced (as in Iraq). The pumps and buckets are supplied against payment in kind by the town merchant or moneyed class; wherever irrigation brings more lands under cultivation, the ownership of the extra land is divided equally between the villagers and the suppliers of water.

The system of tenure is the usual share-tenancy; in the Jezira, according to local custom, the landlord takes one-eighth of the crop to pay taxes, and the remainder is shared equally between landlord and cultivator, the proportion being determined by the supply of labour. With the introduction of machinery—there were about thirty tractors in the area in 1942—the division into employer and labourers has developed: the landowner using the tractor on the land and employing wage labour.

Owing to the scarcity of labour, the position of the agricultural labourer in the Jezira area is better than in the rest of Syria. Health conditions, however, are bad: the Kurds suffer from trachoma and villagers in the Kamichlia district from malaria. In the Euphrates region, the position is worse: the agricultural labourer is weak and underfed, living a hand to mouth existence and exploited by all.

Both in the Jezira and in the Euphrates region there is scope

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## POSSIBILITIES OF DEVELOPMENT

Both in the Jezira and in the Euphrates region there is scope for widening the area cultivated and raising the yields, as the soil is fertile. In the Jezira the use of machinery could be extended—it is already increasing fast. Better livestock production could be achieved by greater use of fodder crops for which conditions are favourable: in the 'Duck's Bill' good clover grows wild. At present fodder crops are not considered worth cultivating.

In the Euphrates region there is great scope for extension of irrigation. But a large scale scheme would be costly because the river runs between high escarpments, which vary in distance between each other up to about 10 miles. To irrigate much larger areas it would be necessary to lift water over the escarpments. There are large areas of uncultivated land, particularly between Abu Kemal and Deir-ez-Zor. Even on the land already cultivated yields of wheat could be much higher: at present the yield is four to six times the seeding rate, and, according to local farmers, could be raised to ten to fifteen times the seed with better irrigation. The high cost of fuel oil is the limiting factor as it also is for tractor work. On the Khabur river improvement of the ancient barrages would permit an extension of irrigation.

It is in this area that there is real scope for a planned settlement of cultivators, with improved methods and a better system of land tenure. The obvious form for such settlement to take would be on the model of the Jewish co-operative farms, small holdings with collective use of machinery and working to a cropping plan; on the uncultivated land such settlement could be undertaken without incurring high capital costs.

So far as the Euphrates Valley is concerned, similar co-operatives based on communal control of water supplies might be started on a small scale. Large-scale irrigation here would be costly, and would necessarily have to be co-ordinated with the irrigation of Iraq. An immediate step needed is to reduce the price of fuel oil.

While it is easy on paper to see the possibilities of such schemes as these, it is not easy to see where in fact the motive power for them is to come from. They will not bring in quick big returns, which are what local farmers and landowners want: the district is remote and the main object of such investment would be a long period rise in the standard of living, in which the moneyed classes are not interested. Present-day Syria is not

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241 possibilities for expanding the total area under cultivation, for improving and increasing irrigation, and for increasing productivity through research and education. They also point to needed improvements in agricultural equipment, in agricultural credit, and in the land tenure system.

241 311 Although estimates vary as to the amount of new land which can be brought into cultivation, all agree that it is possible to double the present planted acreage. Cultivation could be extended in some dry-land areas with improved rotation and fertilization, but in most cases new land can be brought into cultivation only by extending irrigation.

## IRRIGATION

241 312 Information which the United States Legation at Damascus has prepared from reports of the Syrian Ministry of Public Works indicates a total of about 2.4 million acres under irrigation at the present time, of which approximately 60 per cent is from gravity flow and the remainder from pumps of various sorts. Some of the Ministry's data are said to be based on actual surveys, some on interviews, and some simply on estimates. This 2.4 million

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**The most common system of irrigation in the new cotton areas of the Jezira is to draw water like this from streams with pumps powered by diesel engines. The number of pumps in Syria has doubled since 1950.**

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is a very high figure, representing more than 50 per cent of the total land under cultivation, and the United States Agricultural Attache is inclined to believe that the Ministry's figures include the total area served by irrigation systems, whether or not all the land receives water each year. 241 312

There are no large-scale irrigation works in Syria. State and local governments have constructed and now maintain a number of small dams, diversions, and canals, but the total area served by these public works in 1951 was only 100,000 acres. Several other projects, scheduled for completion within the next three or four years, will increase the area under public works another 100,000 acres. Most of these projects are being financed by the federal government out of its regular budget. 312 653

By far the largest area is served by small diversions operated by individuals. The next largest and fastest growing area under irrigation is that served by mechanical pumps. The number of pumps doubled from 1950 to 1951 and the area irrigated increased three times. These pumps are used mostly for drawing water from streams. 312

In the absence of detailed surveys, accurate estimates as to how much water might be available from all sources are impossible to obtain. Draining the Ghab Swamps on the Orontes River west of Aleppo to bring another 100,000 acres into cultivation is now being studied by a Dutch engineering firm, and a large dam on the Euphrates River to impound water in sufficient volume to serve an additional 750,000 acres is under consideration. Several million acres of land along the Euphrates River probably are suitable for cultivation from the standpoint of soil if water becomes available. At the present time irrigation along the Euphrates is limited to the low-lying land between the banks of the river. Through the centuries the river has cut a bed from a half mile to as much as 10 miles wide through the plain, which is now 30 to 50 feet above the water level. It has proved too expensive for individuals to use pumps to pull the water from the river for irrigation.

The same general condition prevails on the main tributary of the Euphrates, the Kabur. Numerous pumps have been installed along the Kabur, and a gravity system in the north, operated by a small dam and canals, is being extended under a current program. It is possible the water would be adequate to extend the gravity system slightly in the southern reaches of the river.

Water might be diverted also from the Tigris River which runs across the northeastern border of Syria. Extensive use of water from any of these international rivers, however, very likely would involve agreements with neighboring countries. Additional water might be provided also by the other rivers in the country. All of these proposals involve tremendously expensive projects beyond the means of the country to finance without outside help.

## CAPITAL AND CREDIT

The highly nationalistic attitude of the Syrians damages the chances of private industry's securing a foreign loan. A recent law requiring all foreign operations to have Syrian managers and at least 50 per cent Syrian capital, together with the questionable security, makes sizable foreign investments unlikely. Under these conditions any foreign loans probably will be made to the government. The Syrian Government has made an obvious point of not obligating itself to another foreign power, and it is unlikely it will accept 471 186 648

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# COTTON IN SYRIA

production, conserve water, concentrate cotton so as to facilitate insect control, and protect the cotton industry against the high costs and low prices that might result from over-extension of production. Farmers are required also to receive licenses to plant cotton from the local representatives of the Ministry of Agriculture and the Cotton Board.

The only marketing regulations issued to date require that all bales show the name of the ginner, the identity, and especially the moisture content of the cotton, which cannot be more than 9 per cent. If false claims are made, the government can take 30 per cent of the cotton as a penalty.

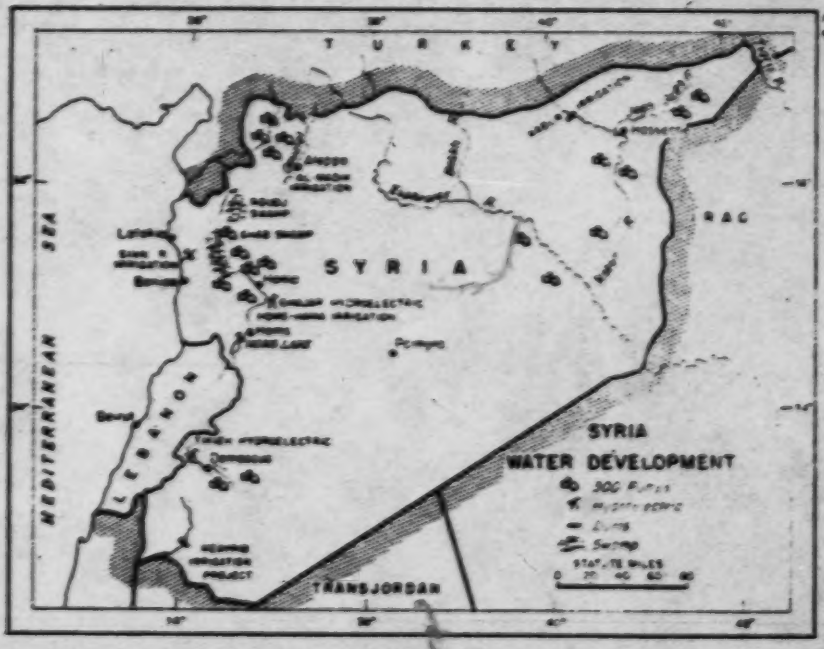
It is obvious that the enforcement of so many scientific regulations and controls over a large area is going to be difficult without a large force of trained technicians and police.

The Director General appreciates that without adequate trained personnel it is not possible to make the regulations completely effective overnight, but he hopes, through education, to obtain the compliance of the producers.

Ambitious research and education programs, another responsibility of the board, are still in the planning stage.

## PROSPECTS

It appears unlikely to expect any significant expansion in production in Syria until yields can be stabilized. A start has been made, but a more intensive research and education program is required on cultural practices (particularly irrigation practices), mechanization, and especially insect control, before much improvement can be expected. Such efforts naturally take considerable time, even when funds and technical assistance are available. Both money and know-how are limited in Syria.



SYRIA

(Visited 13 - 19 January 1953)

131 162 132 58. The Republic of Syria covers approximately 55,700 square miles and has an estimated population of 2,900,000 (including nomads 3,200,000), Arabic speaking and mainly Moslems. There is at present no problem of over-population. Much of the country is at present rain-fed dry land.

311 312 The total cultivable area is 12,500,000 acres of which about 1/3 is under cultivation. Many irrigation projects have been started or are in contemplation. The systems of irrigation do not expose the peasantry in the same degree as in Egypt to bilharzia and the climate is invigorating for much of the year.

241 231 59. Agriculture and cattle breeding are the principal industries. A recent government decree laid down that land not registered must be put at the disposal of the State, who will sell it at a low price in lots of 50 hectares. The land which is thus to be acquired is State Domain which at various times has been appropriated and cultivated by the big land-owning families. The areas involved are said to be 2.3 million hectares of cultivable land and 3.6 million hectares of grazing.

423 185 The land which is to be redistributed must be exploited within 2 years from the date of purchase and must not be resold, although it may be mortgaged to the Agricultural Bank. The Bank will give financial help for the purchase and development of the land.

60. The scheme has been criticized on the ground that in order to avoid a fall in production from the large estates now being cultivated through private capital and a stop being put to the further exploitation of hitherto uncultivated land, the Government will require to make provision for the supply of capital and expert advice to new peasant owners. A scheme for the drainage of a considerable tract in the Jezireh area, known as the Ghab Swamp, is being drawn up as a result of a survey of the area by a foreign firm of engineers. This will also require large capital expenditure.

61. The financing of land redistribution schemes is outside the scope of our mission as is the furnishing of expert advice on new agricultural methods for the more successful exploitation of small estates, except in so far as agricultural extension services can be combined with health and other services appropriate to community welfare organization.

62. The possibility of the Syrian Government's applying for outside technical assistance for any of the above-mentioned purposes is a matter of high policy which we did not feel justified in discussing with the officials whom we had occasion to meet during our visit to Damascus.

647 657 185 63. Dr. Joukhadar, the Director of Labour and Social Affairs, gave the mission the text of a project law (Appendix IV) that had been drafted in his department for establishing rural community centres, somewhat on the lines of those that exist in Egypt.

64. The Decree contemplates that in each province a model centre be established to provide all requisite economic, health, cultural, social and administrative services this being "the only institution that can undertake all the responsibilities and guarantee the success of a programme of village improvement which does not involve

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Wells

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Wells may belong to private individuals or they may be the property of the tribe. Ownership is based on the construction of the wells. The custom varies from place to place but, generally speaking, the person or tribe who has dug the well has primary rights over it. Should he not be using it, other people may do so.

Natural and Artificial Basins

Natural basins are freely used by all. Artificial basins are owned by a person or tribe. Persons other than the owners may be authorized to use these basins against the payment of a fee.

## SYRIA

Water Rights

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Water generally belongs to the owner of the land on which it is located. In areas where water is scarce, however, land and water can be sold and rented separately.

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In Soukhne, along the Euphrates, water sellers may be paid in money or in goods. The owners of small hydraulic enterprises (motor pumps, etc.) on the Euphrates are often paid by the farmers with half of their harvest for the water they furnish even though the cost of irrigation amounts to no more than 8 to 10 percent of the yield.

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According to custom, important personalities have water rights superior to those of the common people. Such rights, sometimes taken by force, are often no more than usage rights which do not imply the real ownership of a spring or a river.

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Ownership of water can be private or collective. Private ownership is rare and applies only to springs or wells of no great importance. It is to be found in densely-populated districts of the Mediterranean slope or in the cultivated steppes. Small gardens irrigated in this way are often individually set up by farmers or wealthy citizens as an investment of their capital. Such gardens are called houstins.

Collective property belongs to the state, to a village or a community. The present legislation provides that all water be owned by the state. Villages, however, also possess hydraulic resources. Occasionally a community is the sole owner of a spring or a water course, while in other cases such ownership is divided among neighboring communities. Old local customs which vary according to regions and communities regulate the distribution of such waters. 312 421

Water Distribution

*Among Members of the Same Community*

If water is abundant with respect to the surface to be irrigated, each user takes what he needs with little consideration for his neighbor. The only limit set up by custom is that the water level on the irrigated surface may not exceed ankle height.

If the flow of water is insufficient with respect to the size of the land to be irrigated, the regulation becomes more complicated. In the rare case where custom does not apply, everyone protects his crops against drought as well as he can. Generally, however, custom guarantees every plot of land a portion of that quantity of water used by the community and which may vary during the year. This portion consists of water taken from a spring or a canal and supplied during a certain period of time (every week, every fortnight, etc.) according to the duration of the rotation period (addâne) which varies, according to the localities, between seven and 32 days.

Time Calculations

The methods of calculating time vary from region to region. Watches, sun dials and hour glasses (keilé) are used. At Kariattein the rotation period (addâne) lasts 15 days, and water agreements are concluded in "Roman hours." These correspond to three hours and are divided into 40 misriyes. The misriyé corresponds to four minutes and thirty seconds. 312 805

In Wabeck Ghouta there are two water turns, one during the day and the other at night. The entire rotation period lasts twelve days. Water portions are calculated in "local"

312 805 hours, that is the twelfth part of an addina. During the equinox, the local day hour is equal to the local night hour and corresponds to a 60 minute flow of water. In winter, however, the local hour is equivalent to more than three and one-half night hours and to less than two and one-half day hours.

In Damascus Ghouta water distribution is particularly complicated.

**Water Policy**

312 A very strict discipline generally rules water diversions for gardens. The communities elect a "water master," generally the moukhar who has administrative functions in the village and who is assisted by water guards called chaouis. These latter supervise the draining system, control the barrages and make certain that no owner abuses his water rights.

***Among Different Villages***

312 621 Such distribution is accomplished in numerous ways. Occasionally each village uses the water according to its own wishes without considering the damage possibly caused to the villages downstream. Such is the case with the water of the El-Awadj (Wadi el-Ajam) near Damascus. Here an enormous amount of water is lost to the villages downstream because of the intense evaporation in summer and the infiltrations into the basaltic regions upstream. The same thing occurs in the villages of Khasrajié and Makroussa.

In other cases, custom assigns the whole or part of the water to each village during a certain period only. In such cases a rotation period is set up between the villages similar to that within the communities. Thus, the water of the Mnin is assigned for four days to Mnin, six days to Tell, one day to Hourné and four days to Barzé.

***Modern Water Distribution***

312 804 Water is distributed with mathematical precisioness only in those regions which are being irrigated according to modern irrigation plans. Territories thus irrigated with the water of the Orontes are those in the communities north of Homs such as Douedir, Deir Bialbé, etc.

Since water supplies are precisely known and are constant throughout the year due to the regulating barrage of Homs Lake, it is possible to calculate exactly the quantity of water each hectare shall receive. This quantity is established at 0 liters 20 seconds per hectare. 312 804

The total rotation period consists of seven days, and each hectare of irrigated land receives every week about 01.20 x 60 x 60 x 24 x 7 or 121 $m^3$. More detailed sub-divisions are foreseen. The irrigation service determines the duration of the water turns. The official time is that shown by the town hall clock of Homs. This system, however, is complex and needs a qualified staff of engineers, controllers and canal guards. It is still the exception in Syria.

**Water Rights in Palmyra**

The district of Palmyra receives its water from deep thermal and surface springs. The water is transported by underground canals (foggaras) which have existed since Roman times and which are necessary to prevent evaporation due to the dryness of the air at Palmyra. They vary from two to six kilometers in length. 312

**Water *Distribution***

This is on a time basis, rotation turns depending on the supply, the number of gardens which are to be watered and the number of persons entitled to water. In Palmyra the turns vary from 12 days in the summer to 18 days in the winter. 312 805

**Water *Rights***

These may be sold. The origin of the water titles is lost in history due to the antiquity of the hydraulic works. 312 923

Since there was no effective government during the last century, water became the property of third parties independently of land ownership. Toward the end of the century the government received no taxes from Palmyra and ceded the main thermal spring to a certain El-Hassan of the Saad family who lived at Homs and to whom persons drawing water paid 80 piasters per hour of watering. For a long time, water rights were the only type of communal property and

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measured the financial well-being of the community.

The number of owners of water rights increased in the course of time as the conveyance of titles and the inheritance of rights increased. By 1922, two-thirds of the villages owned water rights, with the remaining one-third having to purchase such rights.

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In 1923, according to G. Carle, 1/ the time turns were calculated by means of an hour glass which required almost one hour (actually 52 minutes) to empty, a special person being appointed to calculate the time of the turns.

## TUNISIA

### Water Rights at Tozeur 2/

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This oasis derives its water from one wadi and two springs. The water is first divided by a horizontally-placed trunk of a palm tree laid perpendicular to the current and notched with markings equal in number to the desired divisions of water. Further subdivisions are made for secondary redistribution. These vary greatly in number because they can be changed by arrangements made between the persons entitled to water rights following the sale, exchange or inheritance thereof. Only the main divisions of the wadi water turns, up to the twenty-first turn, are fixed, and they are the basis of the entire water distribution system.

### Water Distribution

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The system of water is based on a time schedule. The unit of time for the distribution (*saiehs*) corresponds to the time required for a vase full of water, pierced with holes at the bottom, to be emptied (five minutes or one-twelfth of an hour). The hour is also often calculated from the length of a man's shadow which is measured in feet.

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1/Carle, G., L'Hydraulique Agricole et Industrielle en Syrie.
2/Masselot, F. "Les Dattiers des Oasis du Djerid." Bulletin de la Direction Générale de l'Agriculture, du Commerce, et de la Colonisation de la Régence de Tunis, pp. 137-142.

SOMALIA M04
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The Aqueduct Construction Agency in Italian East Africa

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This agency was set up by the law of 1939 to construct, maintain and use water conduits and to set up other operations relating to the water supply and sanitation facilities of population centers. Several banks were members of this body, and an annual government contribution of 20,000,000 lire was provided. Another decree of the same date approved the constitution of this organization.

## SYRIA

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Syrian water legislation has followed the same evolution as that of Lebanon. During the period of the Ottoman Empire, the articles of the Mejelle Code governed waters. Under the period of the French mandate, the two orders concerning public domain - No. 144/S dated 10 June 1925 and No. 320/S dated 26 May 1926, as well as Legislative Decree No. 288 dated 28 November 1942 which amended Article 25 of No. 320/S - both applied to Syria and Lebanon. These two decrees are still in force in Syria and have already been analysed in the section of this paper relating to Lebanon. Since Syria became completely independent, however, two new legislative decrees have partially amended or repealed a few articles of the preceding rules concerning water.

New Code of Liabilities

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This new code of liabilities, enacted by Legislative Decree No. 148 dated 22 June 1949, stipulates, in Articles 711 to 715, penalties for infraction of clauses on water and has supplemented the above-mentioned order No. 144/S. These articles state:

"Imprisonment not exceeding one year or a fine up to 250 Syrian pounds, or both, is inflicted upon any person who, without special authorisation, commits the following:

1. "the exploitation of underground water or artesian wells, unless it is intended to dig new wells on private property to a depth less than 150 metres;

2. "the execution of any excavations near water canal borders or any drainage systems at a distance less than

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the depth of those excavations, in any case at a distance less than three meters;

3. "the taking of any stones, earth, sand, trees, shrubs or plants from river banks, from permanent or temporary canals or from lakes, ponds or swamps;

4. "the planting of trees or seeds or the placing of anything on the shores of lakes, ponds or swamps, on permanent or temporary canal banks, on passages in between, on any drainage systems or on any authorized, constructed public utility pipes;

5. "the infraction of any sort on the shore of any water source, on permanent or temporary river canals, on swamps, ponds or lakes, on the river canal borders or on public utility drainage pipes;

6. "the prevention of the free flowing of public water;

7. "any permanent or temporary action affecting the quantity and flowing capacity of water (Article 731).

"Any person who, without authorization, organizes new permanent or temporary water canals, or deepens or fills in those already in existence shall be fined according to the provisions of the previous article (Article 732).

"Two years in prison and a fine of 250 Syrian pounds are imposed on any person who destroys or converts all or any of the permanent water establishments with the intent of benefiting from these public waters (Article 733).

"The same fine is imposed on any person who:

1. "throws into any authorized water canal any liquids or materials harmful to public health or the free flowing of the water;

2. "spreads animal manure on any of the land situated within the area delimited by the government for the safeguarding of any water source;

3. "causes any destructive action such as dirtying water sources used for drinking (Article 734).

"Anyone who intentionally dirties any drinking water source is to be imprisoned for from one to three years and shall pay a fine of from 25 to 300 Syrian pounds" (Article 735). 671 312 681

New Taxation on Irrigated Lands

A new legislative decree, No. 34 dated 30 December 1951, amends Articles 2, 3, 4, 6 and 8 of law No. 467 dated 21 February 1949 which imposed an annual tax on land irrigated by state irrigation systems. The new decree reads as follows: 312 651

"This tax is applied per hectare in the following manner:

| Area of Irrigated Land | Khabour Hadrib and Semn Irrigation System | Homs and Hama Irrigation System | Hakh Irrigation System |
|---|---|---|---|
| | L.S. | L.S. | L.S. |
| Up to 5 hectares | 20 | 15 | 5 |
| From 5 to 25 hectares | 25 | 20 | 7.5 |
| From 25 to 50 hectares | 40 | 30 | 10 |
| Over 50 hectares | 50 | 40 | 15 |

"Such tax shall be reduced by half after a lapse of ten years from its first year of application.

"It should be calculated on the whole area held by the taxpayer, whether individually or in partnership with others, with reference to the land irrigated by one and the same irrigation system. The tax on a fraction of a hectare shall be proportionate to the tax on a whole hectare.

"The tax shall take effect on the first day of the year following the year in which the water is brought to the land subject to the tax, even though such water has not been used.

"The term 'Engineer-in-Chief of the region' in Article 8 of Law No. 467 shall be replaced by 'Engineer-in-chief of the hydraulics service of the region' (Article 2).

"The following paragraph is added to Article 6 of Law 467:

61: Capsoms 3-4 (no date) 1964 MI Middle East
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"In regions where there has been neither delimitations nor survey, the areas to be taxed shall be determined on the basis of the taxpayers' declarations and the investigations by such services. Investigation expenses shall be fixed, where necessary, by decision of the Ministry of Finance." (Article 3).

"The provisions of this legislative decree shall come into force on 1 January 1952 and shall have effect as of that date with respect to land exempted by previous legislation (Article 4).

"This legislative decree shall be published and communicated as and where necessary" (Article 5).

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The basic Tunisian legislation actually in force on water is the following:

1. The decree of 24 September 1885 defining public domain.

2. The decree of 24 May 1920 setting up a special water service with an agricultural and industrial hydraulic fund and a water committee.

3. The decree of 5 August 1933 definitely codifying the conservation and utilisation of waters of the public domain and its succeeding amendments (the decrees of 11 May 1935 and 26 November 1936).

4. Other provisions concerning the fees due for the utilisation of public domain waters (the orders of 5 June 1935 and 21 February 1938) and concerning the organization of hydraulic associations (the decrees of 30 July 1936 and 17 March 1939).

According to the decree of 24 September 1885, the public domain consists of:

1. watercourses of all types and the lands included in their embankments;

2. springs of all kinds;

variation exists between the living conditions of the more prosperous farmers and of the peasants, many of the latter possessing little beyond the barest necessities.

The larger cities, as Damascus and Aleppo, have been important junctions on trade routes from India to the Mediterranean for centuries, and reflect the influence of both Eastern and Western civilizations. They are a combination of the old Arab-type city and the modern, with most of the amenities of urban life. The older sections are usually made up of several quarters, dominated by different racial or religious groups. The houses are constructed of stone, brick or reinforced concrete and stucco, with flat or tiled roofs. In Damascus, about one third of the inhabitants live within the limits of the ancient city and a third in the modern residential developments.

The Bedouin follow essentially the same pattern of life in Syria as in other countries of the Near and Middle East. The nomadic tribes dwell in tents made of goats' hair, usually in close association with their livestock. Their standards of living are primitive, both in the tent encampments and the semipastoral settlements.

## ENVIRONMENT AND SANITATION

### Water Supplies

Water supplies are deficient in many sections of the country, and acute shortages may be experienced during the dry season. In the rural areas, domestic supplies are obtained from deep or shallow wells, springs or rivers, and sometimes from rain-water cisterns. *Korazes*, or wells connected by underground conduits which often extend for several miles, and waterholes, dug in the plains or near watercourses, are used in some districts. The village supplies are frequently polluted and responsible for the spread of intestinal infections.

The water supply of Damascus is taken from an underground reservoir at 'Ain el Fije, which is fed by springs in the Anti-

312 Lebanon mountains. It flows by gravity through tunnels to the waterworks in the city, from which it is distributed to the individual houses or, in the more congested districts, to public fountains. The overflow 312 is discharged into the Barada River. The 364 supply is not treated, but its purity is checked daily at 'Ain el Fije, and samples are submitted twice a week to the government laboratories for bacteriologic and chemical examination. The water of the Barada River is no longer used for domestic purposes, being reserved for other municipal requirements.

Untreated water from a spring-fed reservoir supplies the city of Aleppo. The present supply is inadequate, and plans have been projected to conduct water from the Euphrates River to a plant near Aleppo, where it will be treated by sedimentation and 312 chlorination before distribution. Hama obtains most of its supply from wells linked by tunnels, but part of the town depends upon an ancient system in which the water 312 is lifted from the Orontes River by means 406 of huge water wheels and distributed in open overhead aqueducts. These wheels, or *na'auras*, are operated by the force of the current and collect the water in buckets attached at intervals around their circumference. They are often utilized in small irrigation works, where the river is situated below the level of the surrounding plain.

312 Simple methods of irrigation are practiced in many districts bordering the larger rivers. The Al Ghouta, or oasis of Damascus, has been irrigated by the Barada River and its tributaries for centuries: some of the canals have undoubtedly existed since 312 Roman times. Pumps are sometimes em- 406 ployed in the Al Jazira region, while *na'auras* are common in certain sections along the banks of the Orontes, the Eu- 312 phrates and the Khabour rivers. Several large irrigation projects have recently been undertaken under the supervision of the Ministry of Agriculture. These include the irrigation of over 35,000 acres in the Homs-Hama region and the drainage of portions

of the Muzeirib swamp lands along the headwaters of the Yarmuk River. The resettlement program in the Euphrates and the Khabour river basins, which is controlled by a separate governmental organization, calls for the irrigation of extensive areas. Between 20,000 and 30,000 acres had been opened up through irrigation in 1951. Work on the drainage and the irrigation of the Ghab marshes, covering about 100,000 acres in the Orontes river valley northwest of Hama, was started in 1952.

### Waste Disposal

Sewerage systems are available in all the larger cities. The sewage is not treated, however, and the effluent is usually discharged into adjacent watercourses or upon the land for irrigation purposes. In unsewered sections, cesspools are employed in connection with the houses. The methods of sewage disposal are universally primitive in the rural districts. In villages near the larger cities, pit or shallow latrines are frequently found in the individual compounds or provided on a community basis. In the more remote areas and in the poorer villages, pollution of the soil is the general practice. The use of night soil for fertilizer is common in the agricultural communities.

### Fauna and Flora

**Arthropods. Mosquitoes.** Nine species of anopheline mosquitoes have been reported from Syria, three of which—*Anopheles superpictus, A. sacharovi* (— *A. elutus*) and *A. claviger* (— *A. bifurcatus*)—are of major importance in the transmission of malaria. *A. pulcherrimus, A. hyrcanus, A. algeriensis* and *A. sergenti* are of minor and local significance, while *A. marteri* and *A. multicolor* are rare.

*A. superpictus* is widely distributed. It is a prominent vector of malaria in the coastal plains, in the northwestern highland districts and in the river valleys, but is of secondary interest in the Damascus region. It breeds along the margins of the larger rivers and on the edges of mountain streams

highly infected villages were situated on the Gerahi and the Soublakh wadies. Similar surveys in 9 villages in the Tell Abiad area showed an average infection rate of 77 per cent, with the greatest prevalence in the villages on the Tell Abiad and the Slouq branches of the Belikh. Infection is apparently acquired early in life through swimming, washing or other contact with streams inhabited by infected snails. The intermediate host, *Bulinus truncatus*, has been collected from several localities.

Two mobile treatment teams were operated by the Ministry of Health in the infected areas in 1951. Plans for the inauguration of a snail eradication program were also under consideration.

OTHER HELMINTH INFECTIONS. Infection with one or more varieties of intestinal worms is prevalent in all parts of the country. The insanitary habits of the people and the frequent use of night soil as fertilizer promote the spread of the different species. Ascariasis is widely distributed. Infection rates ranging from 30 to 86 per cent have been demonstrated in Aleppo, Damascus, Homs and Hama, as well as in the surrounding villages. The infection is most prominent among the children, in both urban and rural areas. Trichuriasis is also widespread, but enterobiasis and strongyloidiasis tend to be sporadic.

Taeniasis is common. The beef tapeworm, *Taenia saginata*, is enzootic among the cattle, and the popularity of raw, or underdone, meat in certain national dishes is responsible for considerable human infection. The pork tapeworm, *T. solium*, is sometimes encountered among the Christian communities. Occasional infections with the dwarf tapeworm, *Hymenolepis nana*, are observed in most districts.

Hydatid disease is not unusual. *Echinococcus granulosus* is enzootic among dogs, sheep, goats, cattle and camels. In studies reported in 1936,[40] cysts were detected in 25 to 30 per cent of the sheep and the goats examined in slaughterhouses in Aleppo, Damascus and Homs. Infection was uni-

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SILICOSIS AND BENIGN PNEUMOCONIOSIS ARE among the most important occupational diseases, but recognized cases are relatively few in number.

The smoking of *Cannabis indica* (hashish) and other types of drug addiction were formerly common. Within recent years they have been combated with some success by restrictive regulations and educational propaganda.

## SUMMARY

Modern Syria, an independent republic since 1943, encompasses three of the former Levant states—Syria, Latakia and Jebel ed Druz. It has a population of slightly less than 3.2 million which is predominantly Moslem and Arab, but which includes several important religious and racial minority groups. Over three quarters of the inhabitants live in the western and the northwestern provinces which form the western arm of the so-called "Fertile Crescent."

The Ministry of Health (and Public Assistance), with headquarters in Damascus, is responsible for the health and the medical care of the population. Subordinate provincial health departments carry on the activities of the Ministry in each of the 9 *muhafazats*, or provinces. Autonomous municipal organizations function in Damascus, Aleppo, Homs and Hama. A limited number of philanthropic, mission and international agencies carry on health services in close co-operation with the Ministry. In 1951 there were 47 hospitals in Syria, with an aggregate capacity of 2,255 beds—approximately 0.7 beds per 1,000 inhabitants. Of this number, 22 hospitals, with 1,525 beds, were supported by the government, and the remainder by private organizations. In the same year, the Ministry maintained 111 clinics and dispensaries scattered throughout the country, including 3 maternity and child welfare centers, 7 mobile dispensaries and 6 mobile units for the treatment of specific diseases.

Water supplies are usually deficient, ex-

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cept in the vicinity of the principal rivers. 312
Domestic supplies are derived from wells, springs or rivers, and sometimes from water holes or rain-water cisterns. Untreated 312 364
piped water supplies serve all or parts of the larger towns. The municipal supplies of Damascus and Aleppo are controlled for purity, but contamination is frequent in the smaller communities. Sewerage systems are available in the chief cities, but the methods of sewage disposal are generally primitive in towns and villages. The standards of nu- 146
trition vary, depending upon the economic and the social conditions in different regions. Undernutrition and subclinical avitaminosis are widespread, but serious deficiency diseases are encountered only among limited population groups.

The most prominent disease problems are 164
malaria, trachoma and dysentery, both amebic and bacillary. Enteric fevers, tuberculosis, helminthiasis and skin infections are prevalent. Venereal diseases are widely distributed, while bejel is endemic among the nomadic and the seminomadic peoples of the northeastern provinces. Hookworm infection, schistosomiasis, caused by *Schistosoma haematobium*, and leprosy exist in scattered foci. Localized outbreaks of cholera were reported in 1947-48, the first in 20 years. Vaccination against smallpox is com- 751
pulsory, but sporadic cases and occasional epidemics are recorded. Outbreaks of louse- 164
borne typhus are recurrent, while sporadic cases are reported almost annually. Small outbreaks of louse-borne relapsing fever have coincided with regional epidemics. Measles and the common respiratory infections are endemic, and frequently epidemic. Cutaneous leishmaniasis, brucellosis, rabies, tetanus, anthrax, dengue fever and sandfly fever are endemic. Meningococcus meningitis, diphtheria, plague, tick-borne relapsing fever and murine typhus are sporadic. Recognized cases of scarlet fever and poliomyelitis are apparently rare. Doubtful cases of tick-borne typhus and kala-azar have been described.

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## Post-War Period, 1945 to 1954

### Agriculture

During the post-war period both agricultural and industrial output increased rapidly, and although population growth was fairly large there seems little doubt that per capita output rose significantly. 1/ Similarly, although data are very scanty, there is evidence of an increase in consumption and an improvement in the standard of living. 2/

In agriculture, the increase in output was achieved by extending the acreage of cereals and greatly expanding that of cotton; there was also some improvement in methods of cultivation, especially in cotton. The total cultivated area increased from 2,314,000 hectares in 1946/47 to 3,668,000 in 1952/53. 3/ The irrigated area increased more rapidly, from 257,000 hectares 4/ to 400,000 hectares. 5/ The proportion of fallow land seems to have remained unchanged, at one-third of the total. It may therefore be taken that the crop area increased by about 60 per cent.

The increase in the irrigated area was achieved partly by the irrigation projects discussed below, partly by installation by farmers of pumps drawing on river or underground water. In 1953, there were 7,500 pumps, of which 40 per cent were for river water and 60 per cent for underground water. The extension of rainfed crops was achieved mainly by mechanization. In 1953 there were 1,200 tractors, compared with 860 in 1951 and about 300 in 1948; 1,307 tractor ploughs, compared

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1/ National income is estimated to have risen from 1,250 million Syrian pounds in 1950 to £1,410 million in 1953; during that period, the index of wholesale prices of raw materials in Damascus (1949 = 100) fell from 111 to 110. See Sami Wafa el Dajani, "al dakhl al Qaumi fi Suria", Al Abhath, (Beirut, December 1953); Ministry of Agriculture, A Report on the Development of Agricultural Production and Marketing in Syria, and Ministry of National Economy, Statistical Abstract of Syria, 1953 (Damascus, 1954). A breakdown for 1950 shows that 44 per cent of the total was contributed by agriculture and animal husbandry, 13 per cent by commerce, 10 per cent by industry, 9 per cent by transport and communications, 7 per cent by government services, 5 per cent by rents and 11 per cent by other activities (Dajani, op.cit.).

2/ Per capita annual consumption of cotton, woollen and rayon fibres is estimated to have risen from 4.2 kilogrammes in 1951 to 4.6 kilogrammes in 1952 and 5.1 in 1953; the figure for Lebanon and Syria combined had previously risen from 3.9 kilogrammes in 1948 to 4.8 kilogrammes in 1950 (Food and Agriculture Organization, Monthly Bulletin of Agricultural Economics and Statistics, Rome, January 1955). Output of tobacco products increased from an average of 1,638 tons in 1945-47 to 2,075 tons in 1950, 2,448 in 1952 and 2,659 in 1953.

3/ Bureau des documentations Syriennes et Arabes, La Syrie économique, 1953 (Damascus, 1954), mimeographed.

4/ Sir Alexander Gibb, Economic Development of Syria (London, 1947).

5/ Of these, some 250,000 hectares were irrigated by flow and 150,000 hectares by pumps.

Development projects

652 During the period 1945 to 1952, inclusive, Government expenditure on development totalled £S 301.4 million. Of this £S 115 million was spent through the budget, £S 59.5 million was provided from the Reserve Fund, and £S 126.8 million came from loans made by the bank of issue. 1/ The 1954 budget provided £S 71.6 million for development, of which £S 17.2 million were to be spent through the ordinary budget and the balance to come from various extra-budgetary sources. The preliminary cost of projects under study was put at £S 400 million. 1/ Budget appropriations have been spent by Government departments, but projects financed by extra-budgetary expenditure have generally been carried out by special boards created for the purpose. 2/ No foreign financial assistance has been received by Syria.

Agriculture, irrigation and power

652 241 312 Budgetary expenditure on agriculture and irrigation from 1945 to 1952 totalled £S 37.9 million, of which £S 25.3 million went to irrigation and the balance to land survey, agricultural schools, model farms, agricultural and veterinary centres and other projects. Extra-budgetary expenditures included £S 5.7 million for irrigation, £S 21.3 million for increasing the capital of the Agricultural Bank, and £S 6.0 million for pest control.

The largest completed irrigation project is that on the Orontes River, in the Homs-Hama region, which irrigates 22,000 hectares. Further works are under study to irrigate an additional 20,000 hectares upstream; their cost has been estimated at about £S 20 million. Other recently completed projects include that on the Quweiq River, south of Aleppo, which irrigates 15,000 hectares and provides flood control, and the project on the Mzerib, a tributary of the Yarmuk River, which irrigates 2,500 hectares; possibilities for extending both schemes are under study. Irrigation works on the Khabur River, in El Jezira, are very near completion; they have cost £S 9 million and will irrigate 9,000 hectares; considerable further expansion in this scheme is possible and preliminary studies have been made.

Other projects nearing completion include the drainage of the Ruj swamps, near Idlib; the project also provides for the irrigation of 4,000 hectares and the generation of electric power; total costs are put at £S 4 million and completion is scheduled for 1956. The Sinn River project, on the coast south of

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1/ Awad Barakat "Recent Economic Developments in Syria", Middle East Economic Papers, 1954 (Beirut, 1954).

2/ The most important items of expenditure not discussed in this section are £S 33 million for supplying Aleppo with drinking water from the Euphrates, a project which was scheduled for completion in 1954; £S 33 million advanced to municipalities, for water, electricity and public buildings; £S 9.5 million advanced to nationalized electricity companies; £S 26.7 million for Government buildings; £S 8 million for hospitals and clinics, and £S 5.4 million for schools.

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Latakia, is to irrigate 5,000 hectares at a cost of £S 2.6 million; the scheme should be completed by the end of 1955. Projects under study include a scheme on the Barada River, near Damascus, to irrigate 5,000 hectares and provide a capacity of [illegible],000 kilowatts, at a total estimated cost of £S 12 million; the Yusef Pasha dam, on the Euphrates, which would extend irrigation by 100,000 hectares and provide a capacity of 45,000 kilowatts, at an estimated cost of £S 150 million; and a small multi-purpose project on the Kabir River, north of Latakia.

The most important project under way is that on the Ghab, on the Orontes north of Hama. The objective is to reclaim by drainage some 26,000 hectares of land and to irrigate by gravity a total area of 65,000 hectares, 43,000 of which had not been irrigated before.

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The project also includes the building of four hydroelectric stations, with a capacity of 20,600 kilowatts and an estimated annual output of 80 million kilowatt hours; a thermic generator with a capacity of 9,500 kilowatts; and 700 kilometres of roads. Total costs, exclusive of electric installations, are estimated at £S 140 million, of which £S 45 million are for drainage, £S 55 million for irrigation and £S 37 million for roads and bridges. The hydroelectric plants are estimated to cost another £S 17 million and the thermic plant £S 7.6 million. The Government expects to recover its outlay on the scheme by selling, for an estimated £S 150 million, 30,000 hectares of land which it owns in the region and by levying a small irrigation fee. The scheme is expected to raise gross agricultural income by £S 91 million and net income by £S 78 million. Completion is scheduled for 1960. 1/

The Ghab Project Administration was established in 1951, and in 1953 it was authorized to borrow £S 25 million from the Banque de Syrie et du Liban, at 2 per cent interest. A firm of Netherlands consultants, hired by the Government to prepare an over-all plan for the Ghab, presented its report in May 1953. In September 1953 a contract was awarded to a Yugoslav firm for the deepening of the Orontes channel, at a cost of £S 3.3 million. It is expected that contracts for other parts of the project will be awarded soon.

The total area of irrigation projects recently completed or approaching completion is 57,000 hectares and that of schemes planned but not yet begun is 278,000. The total irrigable area, including that at present irrigated, is estimated at 750,000 hectares. 2/.

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The total cultivable area in Syria is put at 5 million hectares, of which one million are at present not cultivated, while 1.6 million are left fallow each year under the prevailing triennial rotation. Present plans call for intensifying production by using leguminous crops to replace the period of fallow,

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1/ "The Ghab Project", by Abdel Basit Khatib, Director General of the Ghab Project Administration (mimeographed document, Damascus, October 23, 1954). See also Abdel Basit Khatib Mashru al Ghab (Damascus, October 1953).

2/ Soubhi Mazloum, "Les Irrigations en Syrie", Annual Bulletin of the International Commission on Irrigation and Drainage, 1953, and "Al mashari al maia fi Suria", Al Hayat, 31 July 1954 (Beirut).